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Bulletin  
of the  
University of New Hampshire

Graduate School  
1954-1955  
January 1954

University of New Hampshire

## **Correspondence**

Prospective graduate students are invited to correspond with University officials as follows:

Dean of the Graduate School for application forms, the Graduate School Bulletin, admissions, graduate status, graduate scholarships, transfer of credits, and programs of study.

Chairmen of Departments for further information and guidance concerning departmental course offerings, individual programs of study, and graduate assistantships.

Director of the Summer Session for information on summer course offerings.

University Alumni Secretary for information concerning the Alumni Association.

University Recorder for transcripts of grades earned at the University of New Hampshire.

Director of Placement for information concerning employment opportunities.

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of the  
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Bulletin  
*of the*  
University of New Hampshire

VOL. XLV

JANUARY 1954

NO. 4

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# CALENDAR

**1954**

JULY						
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**AUGUST**

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**SEPTEMBER**

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**SEPTEMBER**

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**OCTOBER**

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**MARCH**

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**DECEMBER**

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**JUNE**

# University Of New Hampshire Calendar

## Summer Session

### 1954

July 6 Tuesday  
July 7 Wednesday  
Aug. 13 Friday

Summer Session registration  
Classes begin at 7:30 a.m.  
Summer Session closes

## First Semester

Sept. 1 Wednesday  
Sept. 13 Monday  
Sept. 16 Thursday-  
17 Friday  
Sept. 20 Monday  
Nov. 24 Wednesday  
Nov. 29 Monday  
Dec. 1 Wednesday  
Dec. 18 Saturday

Last day for application for admission to Graduate Study for the Fall Semester  
First general Faculty meeting  
Orientation Week begins  
Registration in Graduate School, Thompson Hall 201  
Classes begin at 8:00 a.m.  
Thanksgiving recess begins at 12:00 noon  
Thanksgiving recess ends at 8:00 a.m.  
Last day for filing applications for Graduate Scholarships for Spring Semester  
Christmas recess begins at 12:00 noon

### 1955

Jan. 3 Monday  
Jan. 17 Monday-  
28 Friday

Christmas recess ends at 8:00 a.m.  
Last day for application for admission to Graduate Study for the Spring Semester  
Examination Period

## Second Semester

Jan. 31 Monday  
Feb. (18) Friday-  
(19) Saturday  
March 1 Tuesday  
March 8 Tuesday  
April 2 Saturday  
April 12 Tuesday  
May 6 Friday  
May 20 Friday

Classes begin at 8:00 a.m.  
Winter Carnival — no classes Friday, 1:00 p.m. to Monday, 8:00 a.m.  
Last day for filing applications for Graduate Scholarships for academic year 1955-56  
Town Meeting, classes excused 10:00 a.m. to 2:00 p.m.  
Spring recess begins at 12:00 noon  
Spring recess ends at 8:00 a.m.  
Last day for presenting Ph.D. dissertation at Graduate School office if degree is to be granted in June  
Last day for presenting completed Master's thesis to Graduate School office if degree is to be granted in June  
Last day for final Ph.D. oral examination if degree is to be granted in June  
Examination Period

May 23 Monday-  
June 3 Friday  
June 5 Sunday

Commencement

## **Board of Trustees**

HIS EXCELLENCY, GOVERNOR HUGH GREGG, A.B., LL.B., LL.D., *ex officio*

PERLEY I. FITTS, B.S., COMMISSIONER OF AGRICULTURE, *ex officio*

PRESIDENT ROBERT F. CHANDLER, JR., PH.D., LL.D., *ex officio*

LAURENCE F. WHITTEMORE, M.A., LL.D., Vice-President      Pembroke, N. H.  
September 14, 1944 to June 30, 1956

MARY S. BROWN Center Sandwich, N. H.  
December 20, 1944 to June 30, 1955

AUSTIN I. HUBBARD, B.S., Secretary Walpole, N. H.  
December 20, 1944 to June 30, 1957

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July 1, 1949 to June 30, 1955

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July 1, 1950 to June 30, 1954

**GEORGE L. FRAZER**      **Monroe, N. H.**  
July 1, 1950 to June 30, 1954

\*GEORGE E. COLEMAN, JR., B.S. Exeter, N. H.  
July 1, 1952 to June 30, 1956

WALTER L. BARKER Nashua, N. H.  
September 16, 1952 to June 30, 1955

\*Elected by Alumni.

# The Graduate Faculty\*

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HAROLD C. GRINNELL, M.S., PH.D., Dean of the College of Agriculture and Director of the Agricultural Experiment Station

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THELMA BRACKETT, A.B., Librarian

---

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M. JEAN ALLEN, M.SC., A.M., PH.D., Assistant Professor of Zoology

EDWIN E. ALLING, M.ENGR., Assistant Professor of Civil Engineering

DENNIS B. AMES, M.A., PH.D., Professor of Mathematics

WARREN AVERILL, M.S., PH.D., Assistant Professor of Agricultural and Biological Chemistry

LENIN A. BALER, A.M., PH.D., Assistant Professor of Psychology

CLARA H. BARTLEY, M.A., PH.D., Assistant Professor of Bacteriology

PHILIP S. BARTON, M.ED., Professor of Applied Farming

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SYLVESTER H. BINGHAM, A.M., PH.D., Professor of English

FLETCHER A. BLANCHARD, JR., M.S., Assistant Professor of Electrical Engineering

ROBERT L. BLICKLE, M.S., PH.D., Associate Professor of Entomology

WARREN C. BOWER, M.A., Psychologist, Counseling Service and Instructor in Psychology

EDMOND W. BOWLER, S.B., Professor of Civil Engineering

JAMES R. BOWRING, M.A., PH.D., Associate Professor of Agricultural Economics

WILBUR L. BULLOCK, M.S., PH.D., Associate Professor of Zoology

W. KEITH BURKETT, M.A., PH.D., Associate Professor of Agricultural Economics

REGINALD CALL, A.M., Assistant Professor of English

HERBERT A. CARROLL, A.M., PH.D., Professor of Psychology

R. ALBERTO CASAS, A.M., Associate Professor of Spanish

DAVID G. CLARK, M.S., PH.D., Associate Professor of Physics

WALTER M. COLLINS, M.S., Assistant Professor of Poultry Husbandry

NICHOLAS F. COLOVOS, M.S., Research Associate Professor of Dairy Husbandry

JAMES G. CONKLIN, M.S., PH.D., Professor of Entomology

ALAN C. CORBETT, M.S., D.V.M., Associate Professor of Poultry Husbandry

JOHN COULES, A.M., PH.D., Instructor in Psychology

J. BRUCE CRABTREE, M.A., PH.D., Assistant Professor of Mathematics

RALPH H. CRYESKY, M.A., PH.D., Instructor in Languages

FREDERIC CUNNINGHAM, JR., M.A., PH.D., Assistant Professor of Mathematics

ALBERT F. DAGGETT, M.S., PH.D., Professor of Chemistry

G. HARRIS DAGGETT, M.A., PH.D., Associate Professor of English

ALEXANDER P. DANOFF, A.M., Assistant Professor of Languages

---

\*As of 1953-54.

ROBERT B. DAVIS, S.M., PH.D., Assistant Professor of Mathematics  
CHARLES O. DAWSON, M.S., Professor of Civil Engineering  
CARROLL M. DECLER, M.B.A., Professor of Economics  
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HERBERT C. MOORE, M.S., Associate Professor of Dairy Husbandry  
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Associate Director of the Agricultural Experiment Station, and Professor of Botany  
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OSWALD T. ZIMMERMAN, M.S.E., PH.D., Professor of Chemical Engineering

# **Committees of the Graduate School**

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HERBERT J. MOSS, A.M., PH.D., Dean of the Graduate School, Chairman  
SYLVESTER H. BINGHAM, A.M., PH.D., Professor of English, Secretary  
EDMOND W. BOWLER, S.B., Professor of Civil Engineering  
HAROLD A. IDDLES, M.S., PH.D., Professor of Chemistry  
ARTHUR W. JOHNSON, M.B.A., Professor of Business Administration  
THOMAS O. MARSHALL, ED.M., ED.D., Professor of Education  
GEORGE M. MOORE, M.S., PH.D., Professor of Zoology  
KENNETH S. MORROW, M.S., Professor of Dairy Husbandry

## **Committee on Graduate Scholarships**

THOMAS O. MARSHALL, ED.M., ED.D., Professor of Education  
GEORGE M. MOORE, M.S., PH.D., Professor of Zoology  
WINTHROP C. SKOGLUND, M.S., Professor of Poultry Husbandry  
LAWRENCE W. SLANETZ, PH.D., Professor of Bacteriology, Chairman

# General Information

The Graduate School, which has offered instruction since 1903, has for its objective the bringing together of faculty and qualified students in a spirit of scholarship and research. The Graduate Student is given opportunity to specialize in some field of knowledge, and to develop a maturity of thought and attitude toward his professional field, so that both his professional and his cultural life are enhanced. Graduate work is offered by members of the University departments of instruction and research.

The work of the Graduate School is under the general direction of the Graduate Faculty, composed of certain administrative officers, all department chairmen whose departments are offering graduate work, and all instructors who are offering courses numbered from 101 through 199 in any given year, inclusive of the Summer Session, or who are supervising graduate theses. The Dean of the Graduate School is responsible for the administration of the regulations and requirements pertaining to admission, conduct of work, the granting of advanced degrees, and other pertinent matters.

Graduate programs are offered by the following departments: Agricultural and Biological Chemistry, Agricultural Economics, Agronomy, Animal Husbandry, Bacteriology, Biology, Botany, Chemical Engineering, Chemistry, Civil Engineering, Dairy Husbandry, Electrical Engineering, Entomology, Home Economics, Horticulture, Mathematics, Mechanical Engineering, Physics, Poultry Husbandry, and Zoology leading to the Master of Science Degree; Economics, English, Government, History, Languages, Mathematics, Psychology, and Sociology leading to the Master of Arts Degree; Education leading to the Master of Education Degree; and Agricultural Education leading to the Master of Agricultural Education Degree.

Graduate programs leading to the degree of Doctor of Philosophy are offered in the following departments: Botany, Chemistry, and Horticulture.

Graduate Students are defined as those who meet the requirements for admission to the Graduate School (see Rules and Regulations under Admission), and are registered for an approved program for graduate credit.

## GENERAL REGULATIONS

**ADMISSION.** Admission to the Graduate School may be granted to graduates of all colleges and universities of approved standing, provided their undergraduate records are satisfactory. Before entering upon graduate work the applicant must present evidence that he has had the necessary prerequisite training which will enable

him to pursue with benefit the courses desired. A candidate for admission must have had a cumulative undergraduate average of not less than 2.5 grade point average\*, or the equivalent, for his undergraduate program of study. In addition the candidate for admission may be required to take an achievement test, where the department in which the candidate plans to do his work so requires. These general requirements for admission to the Graduate School are in addition to the special requirements set up by individual departments. For the individual departmental requirements, see the description under the departmental offerings in this bulletin.

A student who desires to register for graduate study must submit to the Dean of the Graduate School the official application for admission to graduate study. Forms for this purpose may be obtained by writing to the Dean of the Graduate School, University of New Hampshire, Durham, New Hampshire. The application must be accompanied by two official transcripts of the student's undergraduate work and any previous graduate work. Transcripts of applicants who are submitted to graduate study become a permanent part of the University files and will not be returned.

Applications for admission to the Graduate School must be submitted before September 1 for the Fall Semester, before May 15 for the Summer Session, and before January 1 for the Spring Semester to guarantee action before the respective registration days. Applications will be accepted after the dates mentioned above provided that the applications are accompanied by complete official transcripts; but it may be necessary in such instances to postpone the evaluation of credentials and the determination of requirements until after the registration period.

**ADMISSION TO CANDIDACY FOR A DEGREE.** Admission to the Graduate School does not imply admission to candidacy for a degree. No Graduate Student is admitted to candidacy for a degree until he has been in residence a sufficient time to enable his instructors to judge of his ability to carry on graduate work. Generally this period of time shall be not less than that required for the completion of 12 credits of graduate work for the Master's Degree, and the passing of the qualifying examination and the completion of the language requirements for the Ph.D. degree. Admission to candidacy for a degree will be determined by the Dean upon the recommendation of the department concerned. The student will be notified by the Dean, in writing, of the decision made.

**REGISTRATION.** A student admitted to graduate study must have his program approved by the chairman of his department or of his guidance committee and the Dean of the Graduate School. Registr-

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\*On grading scale of A equals 4.0; B equals 3.0, C equals 2.0, D equals 1.0.

tion for the Fall Semester in 1954 will take place on Thursday and Friday, September 16 and 17. The necessary registration forms may be obtained at the Office of the University Recorder. Registration for the Spring Semester will take place on Monday, January 31, 1955. Registration for the Summer Session in 1954 will be on Tuesday, July 6, in New Hampshire Hall.. In the Summer Session no student will be admitted to a course carrying graduate credit after three calendar days following Registration Day.

The maximum graduate credit allowed is 16 semester credits for a regular semester and seven for a six-week Summer Session. Only under unusual circumstances will excess credits be allowed and then only with the approval of the Dean of the Graduate School.

**GRADUATE CREDITS.** Graduate credits may be earned only in courses numbered from 51 through 199, and in the thesis, but graduate credits will not be given in any courses so numbered which are open to Freshmen or Sophomores.

**GRADUATE WORK IN THE SUMMER SESSION.** Graduate students who desire to do a part of their work during the Summer Session of the University will find graduate courses offered in many departments. Summer work is accepted toward fulfilling the requirements for an advanced degree. For complete information on the Summer Session see the Bulletin of the University of New Hampshire Summer Session.

**GRADUATE CREDIT FOR SENIOR STUDENTS.** Senior students in the University of New Hampshire may be admitted to the Graduate School. Such Seniors may not substitute courses for which they registered in an undergraduate program for those for which they registered in a graduate program.

**SPECIAL STUDENTS.** Students holding the baccalaureate degrees who have not been admitted to the Graduate School, but who wish to register for graduate courses, must receive the approval of the Dean of the Graduate School and of the instructor concerned.

**GRADES.** Candidates for a degree must earn a grade of A or B in all courses for which a letter grade is given. The grade of Cr. (credit) is given for the thesis. Any graduate student who receives a grade of below B in nine or more credits will be required to withdraw from the Graduate School.

**INCOMPLETE GRADES IN THE GRADUATE SCHOOL.** An incomplete grade in the Graduate School must be made up within a year after the course was to have been completed. This rule does not apply to the completion of the thesis. In any instance where an extension of time beyond the one-year limit appears to be equitable, approval for such extension of time must be secured by a petition approved

by the chairman of the department in which the course was given and by the Dean of the Graduate School.

**DEPARTMENTAL REQUIREMENTS.** The student must meet the special requirements of the department in which he is doing his graduate work and his program must be approved by his adviser and the Dean of the Graduate School. For these special requirements see the department statements in this bulletin.

**TUITION.\*** The tuition is \$250 a year for residents of New Hampshire, and \$500 a year for non-residents.

Any student registering for eight credits or more per semester will pay the full semester tuition. Any student registering for fewer than eight credits per semester shall pay \$10.00 per credit hour. In certain instances Graduate Assistants may be exempted from payment of tuition and fees.

**GRADUATE ASSISTANTSHIPS.** Approximately sixty graduate assistantships are available in the departments of the University. Such assistantships are awarded only to superior students. The continuance of the appointment of a Graduate Assistant is contingent on the maintenance of a high level of scholarship. The service required of the Graduate Assistant may be in the nature of (a) teaching assistance, (b) research assistance, or (c) general service.

Inquiries regarding assistantships should be addressed to the chairman of the department concerned.

There are two categories of assistantships available. For each of these categories exemption from payment of tuition and fees may be granted. Special application must be made for such exemption. The conditions of employment for each category are shown below:

I. \$1200 for the academic year for 20 hours of service per week. Normal academic program: 9 semester hours per semester. Exemption from payment of tuition and fees may be granted as follows:

a. 9 semester hours per semester for two semesters plus full academic program for one Summer Session. Note: this arrangement requires no service to the University during the Summer Session and would make it possible for the assistant to come to the University at his own expense the summer previous to his appointment so as to complete his master's program in one year and two Summer Sessions.

*or*

b. 9 semester hours per semester for two semesters for the first year and if reappointed for the second year,

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\*For tuition rates in Summer Session see Summer Session Bulletin. For tuition rates for extension courses see extension course announcements.

9 semester hours per semester for two semesters. No allowance is made for Summer Session work.

II. \$1630 (10 months at \$120, 2 months at \$240) for the fiscal year for 20 hours of service per week during 9 months, 44 hours per week for two months, with one month of vacation. Normal academic program: 9 semester hours per semester for two semesters. Exemption from payment of tuition and fees may be granted.

In addition to the assistantships mentioned above, in several departments there are research assistantships in connection with research projects, sponsored by such agencies as the Atomic Energy Commission, Office of Naval Research, Naval Bureau of Ordnance, Air Force Cambridge Research Center, Research Corporation, and by industrial organizations.

**TUITION SCHOLARSHIPS.** Up to twenty superior students may be granted exemption from tuition and fees. These awards are subject to the maintenance of a high scholastic record in the Graduate School and may be revoked at the end of any semester if the student does not merit such exemption for the subsequent semester. Foreign students will be considered for scholarship awards. Candidates for these tuition scholarships are required to take the Graduate Record Examination. Inquiries in regard to this examination may be made at the Office of the Division of Student Personnel University of New Hampshire, Durham, N. H., or the Educational Testing Service, P. O. Box 592, Princeton, N. J. Applicants are required to submit an application on a special form available at the Office of the Graduate School.

**ANDREW CHRISTIE SCHOLARSHIP IN POULTRY HUSBANDRY.** This scholarship is provided through the generosity of Mr. Andrew Christie, Treasurer, Christie Poultry Farms, Inc., of Kingston, N. H., in support of the graduate program in the Department of Poultry Husbandry. This scholarship of \$300 is awarded annually to a student who has been admitted to the Graduate School for major work in poultry husbandry and who has demonstrated superior scholastic ability as an undergraduate and is in need of financial assistance. Provided the recipient of this award maintains high scholastic standing during his first year of study, the grant may be continued during the remainder of his graduate study period. The selection of the recipient will be made by a committee composed of the Chairman of the Department of Poultry Husbandry, the Dean of the College of Agriculture, and the Dean of the Graduate School. Application for this scholarship should be made to the Dean of the Graduate School.

**HUBBARD FARMS FELLOWSHIP IN POULTRY HUSBANDRY.** This fellowship of \$1200 is provided through the generosity of Hubbard Farms, Inc., of Walpole, N. H. The grant is made in support of the graduate and research programs of the Department of Poultry Husbandry. The fellowship is awarded annually to a student who has been admitted to the Graduate School for major work in poultry husbandry and who has demonstrated high scholastic ability as an undergraduate, and is in need of financial assistance. If the student maintains high scholastic standing during his first year of graduate study, the award may be continued during the remainder of his graduate study at the University. The selection of the recipient of this award will be made by a committee composed of the Chairman of the Department of Poultry Husbandry, the Dean of the College of Agriculture, and the Dean of the Graduate School. Applications for this fellowship should be directed to the Dean of the Graduate School.

**STAFF SCHOLARSHIPS.** Staff scholarships are available to members of the faculty and their families who wish to do work in the Graduate School. For further details see the current issue of the Staff Handbook of Official Information.

**HONORARY FELLOWSHIPS FOR VISITING SCHOLARS.** Properly qualified scholars, who may desire temporarily the privileges of the library and research facilities of the University, and who are not candidates for a degree may, upon recommendation of the Dean of the Graduate School and the approval of the President of the University, be appointed Honorary Fellows without stipend. Honorary Fellows shall not be required to pay any charges except, possibly, the cost of unusually expensive supplies or equipment.

## **REQUIREMENTS FOR THE MASTER'S DEGREES**

For the degrees of Master of Arts, Master of Science, and Master of Agricultural Education, at least 30 semester credits must be earned. Of these at least 20 must be in courses offered by the major department. In certain fields, however, permission may be granted by the Graduate Council to substitute a limited number of semester credits in courses offered in allied fields for a part of the 20 semester credits normally required in the major department. The major department may prescribe for its students the subjects in which the remaining credits are to be earned. These 30 semester credits for the degrees of M.A., M.S., or M. Ag. Ed. shall include a minimum of 18 credits in courses numbered from 101 through 199, including the thesis. For the requirements for the degree of Master of Education, see the departmental statement in this bulletin.

**RESIDENCE.** A minimum of one full academic year, or five Summer Sessions of six weeks each, will be required of all candidates for the Master's Degree.

If work is taken in Summer Sessions at the University of New Hampshire, the following variations are permissible: The time occupied in earning six credits of approved graduate work elsewhere may be accepted in lieu of one Summer Session of residence. This regulation makes it possible to complete the residence requirements in four Summer Sessions. If the candidate offers acceptable credits earned at this University in Saturday courses, or in extension courses, two semester courses of such work will be counted as the equivalent of one Summer Session in residence.

All graduate work for any degree must be completed in not more than eight years from the time of registration for the first work taken for the degree.

**EXAMINATIONS.** Any department may require a final oral or written examination, or both, of its candidates for the Master's Degree. A candidate will be permitted only two opportunities to take the final oral examination for the Master's Degree, and the time of these oral examinations will be at the convenience of the department concerned, except that all such examinations must be given at least two weeks before the Commencement date in the year in which the degree is to be conferred. The regulations governing the final written examination, when required, will be made by the department concerned, subject to the approval of the Dean of the Graduate School. ..

**TRANSFER CREDITS.** A candidate for a Master's Degree may present for credit a maximum of six credits earned at another graduate school provided that these credits are of a grade of at least B or the equivalent.

**THESIS.** A thesis may be required of candidates for the Master of Arts or the Master of Science Degrees. Consult the departmental statement for thesis requirements.

The thesis must be approved by a committee of three, comprising the instructor under whose direction it was written and two other members of the Graduate Faculty selected by the department chairman and the Dean of the Graduate School.

Each department will determine the date when the candidate must submit for approval a statement of the subject of the thesis and the date when the thesis must be completed.

The number of thesis credits may vary from six to ten, subject to the approval of the student's adviser.

No thesis credit shall be given until the completed thesis has been approved by the committee on the thesis. No letter grade

shall be given for the thesis but its satisfactory acceptance will be recorded with a Cr. (credit).

**THESIS REGULATIONS.** All theses must be typewritten upon standard paper, 8½ x 11 inches, medium weight. The title page shall bear the following statement:

*A thesis submitted to the University of New Hampshire in partial fulfillment of the requirements for the Degree of  
Master of Arts  
Master of Education  
Master of Science*

The second page of each copy of the thesis shall bear the date and signature of each member of the examining committee following the statement:

*This thesis has been examined and approved.*

(Signed) .....  
Name \_\_\_\_\_ Date \_\_\_\_\_

Whenever a thesis is printed, it must be designated as having been accepted as a master's thesis by the University of New Hampshire.

Two copies of the approved thesis, ready for binding, shall be turned in to the Graduate School Office not less than two weeks before Commencement, together with a receipt for the binding fee from the Treasurer's Office. Most departments require one copy of the thesis in addition to the above mentioned two copies. (See departmental requirements in this bulletin.)

### **REQUIREMENTS FOR THE DOCTOR OF PHILOSOPHY DEGREES**

The degree of Doctor of Philosophy is conferred on qualified candidates who have passed an oral or written examination on the subject matter of their field of study, who have completed an original investigation in this field and have embodied the results in an acceptable dissertation, and who have passed an oral examination in defense of the dissertation. The degree of Doctor of Philosophy is essentially a research degree. It is not given merely for the completion of course credits. Graduate programs leading to the degree of Doctor of Philosophy are given by the Departments of Botany, Chemistry, and Horticulture.

**GENERAL REQUIREMENTS.** Normally a minimum of three years beyond the B.A. degree or B.S. degree is required for completion of the work for the Ph.D. Of this period two years will usually be spent on course work. At least one continuous year shall be spent

in residence at the University of New Hampshire. All requirements for the degree must be completed within an eight-year period from the time the student has been admitted to candidacy for the Ph.D.

Candidates for a degree must earn grades of A or B in all the courses required of them for credit (see specific department requirements). A grade of Cr. (credit) is given for the dissertation.

Before becoming eligible for candidacy, the student shall demonstrate a reading proficiency in those foreign languages which are considered essential to research in his particular subject (see specific department requirements).

**GUIDANCE COMMITTEE.** When the student declares his intention to proceed to candidacy for the degree of Doctor of Philosophy, the department of intended major concentration shall notify the Dean of the Graduate School who then, upon recommendation of the department, will appoint a guidance committee. This committee will assist the student in outlining his program and in preparing him for his qualifying examination. To prepare him for the qualifying examination and successful pursuit of his research and course work, the guidance committee may require him to take additional course work, with or without credit.

**THE DOCTORAL COMMITTEE.** At the time of application by the student for the qualifying examination, a doctoral committee is appointed to supervise the qualifying and final examinations and to pass on the dissertation. This committee is nominated by the department of major concentration and appointed by the Graduate Council. It consists of a minimum of five members, usually three from the major department and two from related departments.

**QUALIFYING EXAMINATION.** The qualifying examination may be written or oral, or both. This examination will test: (1) the student's general knowledge in his major and minor work, and (2) his fitness for engaging in research particularly in the subject proposed for the dissertation. The results of the examination will be communicated by the chairman of the major department to the Dean of the Graduate School.

**ADVANCEMENT TO CANDIDACY.** The student may not be advanced to candidacy for the Ph.D. until he has passed the qualifying examination and has completed the requirements for foreign languages to the satisfaction of the major department. The proposed subject of the student's dissertation must be declared at the time of application for advancement to candidacy. Resident full-time members of the University of New Hampshire faculty with rank of Assistant Professor or higher may not be admitted to candidacy for the Ph.D. at this University.

**DISSERTATION.** The dissertation must be a mature and competent piece of writing, a contribution to knowledge, embodying the results of significant and original research.

Two copies of the completed dissertation must be filed with the Dean of the Graduate School two weeks before the date of the final examination and at the same time must be made available for all the examining committee to read. If the dissertation or any part of it is published, two copies of such publication shall be deposited with the Dean of the Graduate School. Publication of abstracts of unpublished dissertations may be required by a department.

**FINAL EXAMINATION.** The final oral examination is conducted by the doctoral committee and is intended to give the candidate an opportunity to defend his dissertation. A written final examination, on subject matter not covered in the qualifying examination, may also be required. This written examination is conducted by the major department. The final examinations must be completed at least two weeks prior to the date of receiving the degree. After consultation with the major department, the Dean may appoint, for participation in the final oral examination, additional members of the faculty under whom the student has worked. The doctoral committee alone shall decide on the merits of the candidate's performance.

### **LIVING FACILITIES**

**HOUSING.** While the University cannot guarantee room reservations in dormitories which are primarily for undergraduate students, every attempt will be made to secure housing for Graduate Students. For information concerning housing, students should write to the Manager, University Housing, Thompson Hall.

**BOARD.** The University operates on a self-service basis a modern, well-appointed dining hall. Regular weekly board and cafeteria service are provided at approximately \$12.

### **COUNSELING SERVICE**

THE COUNSELING SERVICE assists students in discovering vocational abilities and aptitudes, in self evaluation, and in the development of sound plans and objectives. It furnishes students with occupational and educational information as to requirements and opportunities. Personal counsel and guidance are offered to those students who face problems of emotional and social adjustment. It is the University's official testing agency charged with the administration of large-scale testing programs such as the Graduate Record Examination, the Orientation Week Program, and others of a similar nature. In co-operation with the Admissions Office, the Counseling Service participates in the School Testing Service and

is available to all requesting technical information concerning problems of guidance and testing.

## **HEALTH SERVICE**

THE UNIVERSITY HEALTH SERVICE, located in Hood House, is devoted to the protection, improvement, and maintenance of student health. A well-equipped out-patient clinic for diagnosis and treatment of ambulatory patients and a modern hospital of 26 beds, with private and semi-private rooms, wards, and an isolation division for communicable diseases, are constantly available for students who require medical or surgical care. Registered nurses are on duty at all times. Individual health guidance is given through personal conferences with the University Physician.

Injury and illness which require hospital confinement other than in Hood House, services of specialists, operations, ambulance service, special nurse, or special prescriptions are at the expense of the student. Bed patients at Hood House are charged \$2.00 per day. Office Hours of the University Physician are from 8:00 A.M. to 4:30 P.M. daily except Saturday afternoons and Sundays.

## **MEDICAL INSURANCE**

**STUDENTS' MEDICAL REIMBURSEMENT INSURANCE.** In addition to the health service available through Hood House, group accident and sickness insurance giving 12 months' coverage is available to students at the University. This insurance coverage is designed to supplement the program of the University. Complete details may be had on application to John C. Paige and Company, 40 Broad Street, Boston, Mass.

## **DURHAM NOTCH HALL**

DURHAM NOTCH HALL serves as a temporary home for the Student Union, pending erection of the permanent memorial union building. It serves as a gathering place for students. The Student Union Board, on which there is student, faculty, and alumni representation, carries on an extensive cultural, social, and service program.

## **PLACEMENT BUREAU**

THE PLACEMENT BUREAU assists Seniors, Graduate Students, and Alumni to secure positions after graduation. It corresponds with and interviews school superintendents, personnel managers of industrial concerns, and others who employ baccalaureate and advanced degree students, calling to their attention Seniors, Graduate Students, and Alumni who are seeking positions. The Placement Bureau and the Counseling Service are closely allied.

## THE ALUMNI ASSOCIATION

Those individuals who have received an advanced degree from the University of New Hampshire automatically become members of the Alumni Association. The present membership of the Association exceeds 15,000 men and women who represent New Hampshire College and University of New Hampshire classes from 1881 to 1952. Alumni reside in every state of the Union as well as in many foreign countries.

Governed by a Board of Directors of 12 elected members, the Alumni are organized by classes and clubs. Class reunions are held annually in June, both in Durham and in adjacent communities. An annual Homecoming Day in the fall provides opportunity for Alumni to return to Durham while the University is in session. A football game with a traditional rival and a reunion with former classmates and friends are the outstanding features of Homecoming Day. Other Alumni gatherings on campus are also scheduled from time to time during the academic year. Every year 46 UNH Alumni Clubs throughout the United States hold from one to six meetings each. The Clubs' annual meetings are held simultaneously on or near "Ben Thompson Day", April 22. A monthly magazine, *The New Hampshire Alumnus*, issued ten times a year, circulates news of students, faculty, alumni, and the University to Association subscribers. From Alumni Offices in Alumni House on Garrison Avenue, the Association's activities are directed by a permanent Alumni Secretary.

# Departmental Requirements and Descriptions of Courses

If the numerals designating a course running through both semesters are connected by a hyphen, the first semester's work, or its equivalent, is a prerequisite to the second. If the numerals are separated by a comma, properly qualified students may take the second semester's work without having had the first.

Courses numbered 51 through 99 are for graduate and advanced undergraduate students. Courses numbered above 100 are for graduate students only.

The Graduate School reserves the right not to offer an announced course when valid reasons arise.

## AGRICULTURAL AND BIOLOGICAL CHEMISTRY

ARTHUR E. TEERI, *Chairman*

Students admitted to graduate study in Agricultural and Biological Chemistry are expected to have had preparation in the biological sciences, in mathematics, in physics, and in General, Analytical, and Organic Chemistry.

51-52. PHYSIOLOGICAL CHEMISTRY. The chemistry of fats, carbohydrates, and proteins; colloids, enzyme action, digestion, metabolism, and excretion. The qualitative and quantitative examination of blood and urine. Mr. Shimer, Mr. Teeri. *Prereq.:* Satisfactory preparation in Organic Chemistry and Quantitative Analysis. 3 lec.; 2 labs.; 5 cr.\*

53, 54. AGRICULTURAL ANALYSIS. A study of the methods of analysis of soils, fertilizers, feeding stuffs, and other products important in agriculture. Mr. Teeri and staff. *Prereq.:* Satisfactory preparation in Organic Chemistry and Quantitative Analysis. 1 lec.; 3 lab.; 4 cr.

56. PHYSIOLOGICAL CHEMISTRY. The qualitative and quantitative methods fundamental to medical diagnostic work. The chemistry of fats, carbohydrates, and proteins; enzyme action, digestion, metabolism, and excretion. Mr. Teeri. *Prereq.:* Satisfactory preparation in organic chemistry. 3 lec.; 2 lab.; 5 cr.

101, 102. ADVANCED BIOCHEMISTRY. An advanced study of the fundamental principles of biochemistry. Mr. Teeri. 3 lec.; 3 cr.

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\*Under special conditions a student may register for the lectures in this course (3 credits) after obtaining the consent of the instructor and the approval of the Dean.

103, 104. SPECIAL PROBLEMS. Conferences, and library and laboratory work on special phases of chemistry in its relation to agriculture and biology. Mr. Teeri, Mr. Phillips, Mr. Shimer, Mr. Averill. *Prereq.:* Satisfactory preparation in Analytical, Organic, and Biological Chemistry. Subject matter and credits to be arranged.

105, 106. BIOCHEMISTRY SEMINAR. Reports and discussions of biochemical literature and recent developments in biochemistry. *Pre-req.:* Permission of the Department Chairman. 1 cr.

THESIS. To be arranged. 6-10 cr.

## AGRICULTURAL ECONOMICS

WILLIAM F. HENRY, *Chairman*

Admission to graduate study in Agricultural Economics may be granted those who have satisfied the requirements for admission to the Graduate School and present evidence of satisfactory training in the fields of agriculture and economics. Normally, this will mean a degree from a college of agriculture and 9 or more credits in economics, including Agricultural Economics, as evidence of aptitude for advanced training in the field of Agricultural Economics. The requirement of a degree from a college of agriculture may be waived in the case of a mature student who has a degree in a field other than agriculture, (providing he presents evidence of an intimate knowledge of farm production and marketing practices), upon approval of the Chairman of the Department.

51. COOPERATIVE BUSINESS. Stress is placed on the organizational, legal, and financial problems of farmers' business corporations which are engaged in buying and selling. Selected problems of general agricultural marketing are integrated with the course content. Mr. Henry. 3 lec.; 3 cr.

55. AGRICULTURAL MARKETING. The market structure responsible for the distribution of agricultural products will be reviewed. Emphasis will be placed on the theory of price determination, interregional trade, imperfect competition, and public and private administration of prices in agriculture. Mr. Bowring. 3 lec.; 3 cr.

60. AGRICULTURAL POLICY. Public policies that are concerned with land utilization, conservation of soil and forest resources, price supports, and production control will be studied and appraised. The objectives and effects of various action programs will be noted. Mr. Bowring. 3 lec.; 3 cr.

67-68. SPECIAL PROBLEMS IN AGRICULTURAL ECONOMICS. Special assignments in readings and problems to satisfy students' needs. Mr. Henry, Mr. Burkett, Mr. Bowring. 1 to 3 cr.

**101-102. ADVANCED FARM MANAGEMENT.** Principles and problems of farm management as applied to the organization and operation of individual farms. Mr. Burkett. 3 cr.

**106. ADVANCED LAND UTILIZATION AND AGRICULTURAL POLICY.** An appraisal of national and local policies and proposed action programs affecting American agriculture. Assigned readings and conferences. Mr. Burkett. 3 cr.

**107. ADVANCED STATISTICS FOR AGRICULTURE.** Use of statistical tools in measurement and analysis of data. Assigned problems and conferences. Mr. Bowring. 3 cr.

**103. ADVANCED AGRICULTURAL ECONOMICS.** Appraisal and application of relevant economic theory to problems in food production, marketing, and consumption. Mr. Henry. 3 cr.

**181-182. READING AND RESEARCH IN AGRICULTURAL ECONOMICS.** With the advice and consent of the instructor, a student, prepared by training and experience to do independent work, may register for a reading and research course. The student will undertake assigned problems and readings under guidance of the instructor.

**THESIS.** To be arranged. 6-10 cr.

## **AGRICULTURAL EDUCATION**

**PHILIP S. BARTON, *Program Chairman***

Students majoring in Agricultural Education are expected to have had sufficient undergraduate work in this field to fulfill the requirements for state certification as a teacher of Vocational Agriculture or to be desirous of meeting such qualifications through graduate study.

The program is offered during the Summer Session only. The sequence of courses will cover a period of four summers and will then be repeated.

**101. ADVANCED METHODS IN FARM MECHANICS INSTRUCTION.** A study of the Farm Mechanics problem and how to approach it in the high school. Consideration will be given from the standpoint of its place as a part of the course of study in Vocational Agriculture. The physical setup, as well as the processing of supplies and equipment, methods of supervision and direction of Farm Mechanics projects, and the preparation and presentation of demonstrations will be included. Mr. Gilman. 2 cr. (Offered in 1957.)

**102. METHODS IN TEACHING THE OPERATION AND MAINTENANCE OF FARM TRACTORS.** Methods in teaching the servicing and

maintenance of the various mechanical systems found on farm tractors. Teaching plans, techniques of instruction, and essential skills will be considered. Demonstrations, discussions, and laboratory participation will make up a considerable part of the class work. Mr. Gilman. 2 cr. (Offered in 1955.)

**103. METHODS IN TEACHING THE CARE AND MAINTENANCE OF FARM MACHINERY.** Course content includes: Methods in teaching the care and maintenance of farm machinery, teaching plans, techniques of instruction, and the essential skills. Demonstrations, discussions, and laboratory participation will make up the balance of the work in this course. Mr. Gilman. 2 cr. (Offered in 1956.)

**104. PROGRAM PLANNING IN VOCATIONAL AGRICULTURE.** The gathering of basic community data; its interpretation and evaluation will be considered. The data obtained will serve as the basis for the preparation of the long-time plan, annual plan, and course of study for the local Department of Vocational Agriculture. Mr. Barton. 2 cr. (Offered in 1957.)

**105. SUPERVISED FARMING IN VOCATIONAL AGRICULTURE.** The course will cover developing of cooperative relations, selecting and developing individual programs with the students, and the supervision and evaluation of such programs. Mr. Barton. 2 cr. (Offered in 1954.)

**106. PREPARATION AND USE OF VISUAL AIDS FOR TEACHING VOCATIONAL AGRICULTURE.** The purposes of visual aids and the kinds best adapted to use in the program, together with their preparation and use, will be given primary consideration in this course. 2 cr. (Offered in 1954.)

**107. ORGANIZATION AND SUPERVISION OF THE FUTURE FARMERS OF AMERICA PROGRAM.** The purposes and organization of the Future Farmers of America, establishing the local chapter, planning and developing a program of work, ways and means of improving the local chapter, together with methods of evaluation will be covered. 2 cr. (Offered in 1954.)

**108. ORGANIZING, TEACHING, AND SUPERVISING YOUNG AND ADULT FARMER PROGRAMS.** The techniques of organization, course planning, methods of teaching, and the supervision of farming programs as they apply to instruction with out-of-school groups will be given consideration. Mr. Barton. 2 cr. (Offered in 1955.)

**109. COMMUNITY ORGANIZATION AND PUBLIC RELATIONS.** A study of the composition, purposes, and objectives of the various social and economic organizations operating in local communities;

importance of their membership to the general welfare of the area and the development of a public relations program for a teacher of agriculture to promote the program of Vocational Agriculture on the local, state, and national level. 2 cr. (Offered in 1956.)

110. PHILOSOPHY OF VOCATIONAL EDUCATION. A study of the development of Vocational Education in the United States with emphasis on the socio-economic influences responsible for its establishment. Its relationship with general education, together with the coordination of instructional programs in the various vocational fields. 2 cr. (Offered in 1956.)

111. RESEARCH IN AGRICULTURAL EDUCATION. Individual study problems in various phases of Agricultural Education. *Prereq.*: Permission of staff. 1-4 cr.

## AGRONOMY

Roy L. DONAHUE, *Chairman*

Students admitted to graduate study in Agronomy should have had basic courses in soils and crops as well as adequate preparation in the biological and physical sciences.

51. PASTURE-HAYLAND AND TURF MANAGEMENT. The choice of species, and the preparation and maintenance of stands and swards through adequate management and fertilization. Consideration also will be given to lawns and turf areas. Current research literature, individual problems, and field trips will be utilized. Mr. Higgins. *Prereq.*: Agronomy 11, 14, 21, and 28, or permission of the instructor. 2 lec.; 1 lab.; 3 cr.

57. SOIL PHYSICS. Physical properties of soils: their measurement and relation to structure, water movement, aeration, and temperature. Mr. Miller. *Prereq.*: Agronomy 11, 14; and Physics 2. 2 lec.; 1 lab.; 3 cr. (Alternate years; not offered in 1954-55.)

58. SOIL CLASSIFICATION AND MAPPING. The origin, morphology, classification, and mapping of soils. Relationships of the great soil groups of the world to crop production. Special emphasis is given to the soils of New Hampshire. Mr. Kardos. *Prereq.*: Agronomy 11, Geology 1 or 7, and other courses at the discretion of the instructor. 2 lec.; 1 lab.; 3 cr. (Alternate years; not offered in 1954-55.)

59. SOIL CHEMISTRY. A study of the methods for evaluating nutrient levels in soils and of principles underlying the liberation, absorption, and fixation of nutrient elements in soils. Mr. Kardos. *Prereq.*: Agronomy 11, 14, and Agr. Chem. 1. 2 lec.; 1 lab.; 3 cr. (Alternate years; offered in 1954-55.)

60. SOIL CONSERVATION. The causes and effects of soil erosion. Cropping systems, fertilizer practices, and structural devices used in erosion control. Mr. Kardos. *Prereq.*: Agronomy 11, 14, and 21. 2 lec.; 1 lab.; 3 cr. (Alternate years; offered in 1954-55.)

62. PLANT BREEDING OF FIELD CROPS. A study of the methods for developing and evaluating improved varieties of grasses, legumes, and cereal crops. Major emphasis will be given to methods of corn breeding. Basic genetic principles will be reviewed. Laboratory to consist of field trips, practical work in selfing and crossing, and studies of inheritance. In addition, field plot designs and their statistical analyses will be studied. Mr. Dunn. *Prereq.*: Zool. 61. 2 lec.; 1 lab.; 3 cr.

71, 72. AGRONOMY SEMINAR. Library and reference work on special phases of soil and crop problems. Practice in looking up literature and in preparation of reports and abstracts. Staff. *Prereq.*: Agronomy 11, 14, and 21. 1 to 3 cr.

101. CROP ECOLOGY. A study of field crops in relation to their climatic, physiographic, and biotic environment. Mr. Donahue. *Prereq.*: Agronomy 11, 21, and Botany 42. Hours to be arranged. 3 cr.

103. ADVANCED SOIL FERTILITY. Lectures, discussions, problem work in the laboratory and greenhouse. Discussion of theories concerning nutrient availability and fixation. Use of biological methods for major and minor nutrient assays. Principles of experimental design in field plots. Mr. Kardos. *Prereq.*: Agronomy 57, 59, and Chemistry 17. 3 cr.

104. ADVANCED SOIL CHEMISTRY. Lectures, discussions, and problem work in laboratory. Physical chemistry of soils and soil colloidal phenomena. Anion and cation exchange mechanisms in soils. Theories of swelling. Crystallographic properties of the clay colloids and their relation to cation and anion exchange. The nature of soil acidity. Oxidation-reduction phenomena in soils. Mr. Kardos. *Prereq.*: Agronomy 57, 59, and Chemistry 17. (At least one semester of Physical Chemistry recommended.) 3 cr.

THESIS. A thesis study of some phase of Soil Science or Plant Science is required of all candidates for an advanced degree. 6 to 10 cr.

### ANIMAL INDUSTRY

KENNETH S. MORROW, *Chairman of Dairy Husbandry*  
LORING V. TIRRELL, *Chairman of Animal Husbandry*

Students admitted to graduate study in Animal Industry are expected to have had satisfactory undergraduate training in Dairy Husbandry, Dairy Industry or Technology, or Animal Husbandry.

## **Animal Husbandry Courses**

51. ANIMAL BREEDING. The principles and practices of breeding farm animals, including cross-breeding, in-breeding, selection, inheritance, breed analysis, reproductive efficiency, fertility, sterility, Mendelism in relation to farm animals, acquired characteristics and variation. Practice is given in tracing and studying pedigrees. Mr. Tirrell. 2 lec.; 1 lab.; 3 cr.

52. ANIMAL HUSBANDRY SEMINAR. Library and reference work and the preparation of papers on various Animal Husbandry subjects. Mr. Tirrell. *Prereq.:* Animal Breeding. Hours and credits to be arranged.

105. PROBLEMS IN ANIMAL BREEDING. Studies in practical breeding problems with beef and dual-purpose cattle, sheep, horses, and hogs. The genetic principles important to successful livestock production will be emphasized. Mr. Tirrell. *Prereq.:* A major in Animal Husbandry or Dairy Husbandry. 2 lec.; 1 lab.; 3 cr.

106. MEATS, LIVESTOCK MARKETS, AND PRODUCTS. The essential factors in meat selection, cutting, curing, and smoking; study and discussion relative to the problems of livestock marketing and the procedure in the large central markets. Trips are taken to various packing plants. Mr. Tirrell. *Prereq.:* A major in Animal Husbandry or Dairy Husbandry. 2 lec.; 1 lab.; 3 cr.

## **Dairy Husbandry Courses**

60. DAIRY SEMINAR. Recent agricultural experiment station and other literature covering the field of dairy production. Practice in looking up literature and in the preparation of oral and written reports. Staff. 2 lec.; 2 cr.

62. ADVANCED DAIRY SCIENCE. Basic data, fundamental observations, and discussions of research contributing to the present status of the dairy industry. Mr. Moore. *Prereq.:* Adequate preparation in chemistry and bacteriology. 2 lec.; 2 cr.

64. MILK PRODUCTION. Feeding and management of dairy animals, calf feeding, raising young stock, and feeding for economical milk production. Mr. Keener. 2 lec.; 1 lab.; 3 cr.

65. MARKET MILK. The producing, handling, and distributing of market and certified milk, dairy farm inspection, and control of milk supply. Mr. Moore. 2 lec.; 1 lab.; 3 cr.

66. ICE CREAM. The making, handling, and marketing of ice cream and ices. Mr. Moore. 2 lec.; 1 lab.; 3 cr.

101. ANIMAL NUTRITION. Incidental lectures, assigned reading, and laboratory practice in methods of research with major emphasis on protein and energy metabolism. Mr. Colovos. *Prereq.*: A major in Animal Husbandry or Dairy Husbandry, or equivalent. 3 cr.

102. (102) ADVANCED DAIRY CATTLE. Special emphasis will be given to the analysis and formulating of breeding programs and to milk secretion and factors influencing the quantity and quality of milk. Mr. Morrow. *Prereq.*: A major in Animal Husbandry or Dairy Husbandry. 2 lec.; 1 lab.; 3 cr.

107. TECHNICAL CONTROL. Chemical and bacteriological laboratory methods used in the technical control of milk and milk products. Mr. Moore. *Prereq.*: Dairy Bacteriology. 2 lec.; 1 lab.; 3 cr.

109, 110. SPECIAL PROBLEMS IN DAIRY MANUFACTURE. Detailed study of some special phase of dairy manufacturing. Mr. Moore. *Prereq.*: A major in Dairy Husbandry. Conferences and special assignments. 3 cr.

111, 112. SPECIAL PROBLEMS IN DAIRY PRODUCTION. Study of some special phase of breeding or feeding as related to dairy-herd management. Mr. Morrow, Mr. Keener. *Prereq.*: A major in Animal Husbandry or Dairy Husbandry. Conferences and special assignments. 3 cr.

THESIS. Hours and credits, from 6 to 10, are to be arranged.

## BACTERIOLOGY

LAWRENCE W. SLANETZ, *Chairman*

Students admitted to graduate study in Bacteriology are expected to have had preparation in the biological and physical sciences and in the basic courses in Bacteriology. A thesis is required and a candidate for the Master's Degree shall pass an oral examination covering his graduate courses and thesis.

53. IMMUNOLOGY AND SEROLOGY. The theories of infection and immunity; production of vaccines; toxins, and antiserums; serological techniques for disease diagnosis and identification of bacteria, including agglutination, precipitin, and complement fixation tests. Mrs. Bartley. *Prereq.*: Pathogenic Bacteriology. 2 lec.; 2 lab.; 4 cr.

55, 56. PROBLEMS IN BACTERIOLOGY. Special problems, depending upon the training and desire of the student. Elective only upon consultation. Mr. Slanetz and members of the staff. Credits to be arranged.

57, 58. BACTERIOLOGY SEMINAR. Reports and discussions on current literature and recent developments in Bacteriology. Mr. Slanetz and staff. *Prereq.*: One year of Bacteriology and consent of instructor. 1 rec.; 1 cr.

101. PHYSIOLOGY OF BACTERIA. A study of the growth, nutrition, and metabolism of bacteria; influence of physical and chemical environment on growth; bacterial enzymes, protein decomposition and fermentation. Mr. Katz. *Prereq.*: Biological Chemistry (may be taken concurrently) and one year of Bacteriology. 2 lec.; 2 lab.; 4 cr.

104. SYSTEMATIC BACTERIOLOGY. A study of procedures and methods for the classification of bacteria; review of modern systems of classification. Mr. Slanetz. *Prereq.*: One year of Bacteriology. 2 lec.; 1 lab.; 3 cr.

108. PATHOGENIC AND DIAGNOSTIC BACTERIOLOGY. A study of the morphological, cultural, biochemical, serological, and pathogenic characteristics of microorganisms causing human and animal diseases. Students will be expected to perform the laboratory procedures for the diagnosis of various infectious diseases. Mr. Slanetz, Mrs. Bartley. *Prereq.*: General Bacteriology. 2 lec.; 2 lab.; 4 cr.

109, 110. BACTERIOLOGY SEMINAR. Reports and discussions on bacteriological literature and recent developments in bacteriology. Mr. Slanetz and staff. *Prereq.*: Permission of the instructor. 1 rec.; 1 cr.

153. ADVANCED IMMUNOLOGY AND SEROLOGY. The theories of infection and immunity; production of vaccines; toxins, and antiserums; serological techniques for disease diagnosis and identification of bacteria, including agglutination, precipitin, and complement fixation tests. Students will be assigned special problems on certain phases of the lecture or laboratory work. Mrs. Bartley. *Prereq.*: Pathogenic Bacteriology. 2 lec.; 2 lab.; 4 cr.

THESIS. 6-10 cr.

## BIOLOGY

GEORGE M. MOORE, *Chairman of Committee*

Students admitted to graduate study in Biology must have completed an undergraduate major in Biology or in some field of the biological sciences. Suitable training in the physical sciences is also necessary. Students who lack undergraduate training in any of the fields of the biological sciences may be required to complete certain courses in these fields which do not carry graduate credit before they are admitted to candidacy for a degree.

Graduate work in Biology is under the direction of a committee consisting of the Chairmen of the Departments of Bacteriology, Botany, Entomology, and Zoology. This committee shall determine, in light of the student's objectives, the courses and requirements to be met by the candidate. Candidates for the Master's Degree in Biology shall pass an oral examination covering their general preparation in the field, and the thesis.

**THESIS REQUIREMENTS.** A thesis may be required of a student who secures the Master's Degree in Biology. The number of thesis credits will be *six*. In certain cases, where it seems appropriate in the light of the student's educational objectives, the thesis requirement may be waived. Permission to waive the thesis requirement will be granted on recommendation of the committee mentioned above. When permission is granted to waive the thesis requirement, the student shall present two graduate credits in Seminar (Bact. 57, 58; or Zool. 87, 88).

**91. BIOLOGY-EDUCATION. PROBLEMS IN THE TEACHING OF HIGH-SCHOOL BIOLOGY.** Objectives and methods of teaching; the selection and organization of materials; the preparation of visual aids; the setting up of aquaria and other projects. Some instruction in the preparation of biological materials for the classroom; instruction in making models and aquaria. The use of the field trip as a tool in teaching high-school biology. Mr. Moore. *Prereq.:* Two years of biological sciences and Principles and Problems of Teaching in the Secondary School. 2 rec.; 1 lab. or field trip; 3 cr.

**95. BIOLOGY-EDUCATION. PROBLEMS IN THE TEACHING OF HIGH-SCHOOL BIOLOGY.** Objectives and methods of teaching; the selection and organization of materials; the preparation of visual aids; the setting up of aquaria and other projects. Some instruction in the preparation of biological materials for the classroom; instruction in making models and aquaria. The use of the field trip as a tool in teaching high-school biology. This course is acceptable for Biology-Education 91; however, students who already have credit for Biology-Education 91 will not receive credit for this course. *Prereq.:* Either 1) Two years of biological science and Principles and Problems of Teaching in the Secondary School or 2) A year of teaching of high-school biology. 2 rec.; 2 lab. or field trip; 4 cr. (*Offered in summer only.*)

For listings of other courses see: Bacteriology, Botany, Entomology, and Zoology.

## BOTANY

ALBION R. HODGDON, *Chairman*

Students admitted to graduate study in Botany are expected to have had adequate preparation in basic Botany courses and in the physical sciences. The candidate for the M.S. degree will be required to pass an oral examination and to prepare a thesis. Thesis credits may be from 6-10 depending on the research problem involved. Students who are working toward the Ph.D. degree must demonstrate a reading knowledge of two foreign languages, preferably French and German. The subject-matter fields for graduate study in Botany are: Systematic Botany and Plant Ecology, Mr. Hodgdon; Plant Physiology, Mr. Dunn; Plant Morphology and Anatomy, Miss Nast; Plant Pathology, Mr. Rich; Mycology, Mr. Richards.

51. PLANT PATHOLOGY. The nature of disease in plants, the etiology, symptomatology, and classification of plant diseases. Mr. Rich. *Prereq.*: General Botany or The Plant World. 1 lec.; 2 lab.; 3 cr.

52. PRINCIPLES OF PLANT-DISEASE CONTROL. Exclusion, eradication, protection, and immunization, and the specific, practical methods used to control plant diseases. Mr. Rich. *Prereq.*: General Botany or The Plant World. 1 lec.; 2 lab.; 3 cr. (Alternate years; offered in 1953-54.)

53. PLANT ANATOMY AND CYTOLOGY. The anatomy of vascular plants with special emphasis upon tissue development and structure. Includes a brief study of cytological phenomena. Miss Nast. *Prereq.*: Bot. 1 or Bot. 3. 1 lec.; 2 labs.; 3 cr.

55. ADVANCED SYSTEMATIC BOTANY. The principles and laws of plant classification and nomenclature; study of plant families, field, and herbarium work. Mr. Hodgdon. *Prereq.*: Systematic Botany. Hours to be arranged. 4 cr.

56. PLANT PHYSIOLOGY. Structure and properties of the cell; absorption and movement of water; metabolism; growth and irritability. Mr. Dunn. *Prereq.*: Bot. 1 or Bot. 3, and one year of Chemistry. 2 lec.; 2 lab.; 4 cr.

57, 58. PROBLEMS IN (a) SYSTEMATIC BOTANY, (b) PLANT PHYSIOLOGY, (c) PLANT PATHOLOGY, (d) PLANT ANATOMY, AND MORPHOLOGY, AND (e) PLANT ECOLOGY. Elective only upon consultation with Chairman of Department. Mr. Hodgdon, Mr. Dunn, Mr. Rich, Miss Nast. Hours to be arranged. 2 to 6 cr.

102. ADVANCED PLANT ECOLOGY. Requirements for growth; specialization and adaptation; geographic and physiographic re-

lations. Regional floras. Interpretation and classification of habitat. Special problems are assigned. Mr. Hodgdon. Incidental lectures, laboratory, and field work. 4 cr. (Alternate years; not offered in 1953-54.)

104. HISTOLOGICAL TECHNIQUES. A methods course in embedding, sectioning, and staining plant tissues, and preparation of toto mounts. Miss Nast. *Prereq.:* General Botany or The Plant World. 3 cr. (Alternate years; not offered in 1953-54.)

105. ADVANCED PLANT PHYSIOLOGY. Absorption, translocation, transpiration, and excretion of water, and effect of environmental factors upon these phenomena; permeability and mineral nutrition. Mr. Dunn. *Prereq.:* Plant Physiology or equivalent, or adequate preparation in the physical sciences. Conferences, laboratory, and assigned reading. 3 cr. *Note:* Advanced Plant Physiology 106 also should be taken for a complete covering of the subject. (Alternate years; offered in 1953-54.)

106. ADVANCED PLANT PHYSIOLOGY. Photosynthesis; respiration, growth, reproduction, and movement; effect of environmental factors on these phenomena. Mr. Dunn. *Prereq.:* Plant Physiology or equivalent, or adequate preparation in the physical sciences. Conferences, laboratory, and assigned reading. 3 cr. (Alternate years; offered in 1953-54.)

107, 108. PROBLEMS IN (a) SYSTEMATIC BOTANY, (b) PLANT PHYSIOLOGY, (c) PLANT PATHOLOGY, (d) PLANT ANATOMY, AND MORPHOLOGY, AND (e) PLANT ECOLOGY. Elective only upon consultation with Chairman of Department. Mr. Hodgdon, Mr. Dunn, Mr. Rich, Miss Nast. Hours to be arranged. 2 to 6 credits.

109-110. A reading course to acquaint students with cytological principles and cytological literature. Miss Nast. Conferences to be arranged. 2 cr.

112. MYCOLOGY. Studies of the parasitic and saprophytic fungi, their growth, reproduction, and identification. Mr. Richards. Laboratory and assigned reading. 1 lec.; 2 lab.; 3 cr.

THESIS. 6-10 cr.

## CHEMICAL ENGINEERING

Oswald T. Zimmerman, *Chairman*

To be admitted to graduate study in Chemical Engineering an applicant shall be expected to have completed a course of study substantially equivalent to that required for the degree of Bachelor of Science in Chemical Engineering in this University. How-

ever, students with good undergraduate records but with deficiencies in certain areas may be admitted on condition that they complete specified courses without credit to make up for their deficiencies.

71-72. UNIT PROCESSES. The important inorganic and organic industrial chemical processes from the point of view of the basic chemical reactions and physical operations involved. Mr. Lavine. *Prereq.*: Quantitative Analysis. 2 lec.; 2 cr.

74-75. UNIT OPERATIONS. The theory and practice of the fundamental chemical engineering unit operations, including flow of fluids, flow of heat, evaporation, distillation, drying, filtration, gas absorption, extraction, humidification and air conditioning, crystallization, crushing and grinding, and size separation. Mr. Zimmerman. *Prereq.*: Physical Chemistry. 3 lec.; 3 cr.

76. CHEMICAL ENGINEERING ECONOMICS. The economic factors involved in industrial chemical processes and the application of economic balances to the design and selection of chemical engineering equipment. Mr. Zimmerman. *Prereq.*: Unit Operations. 3 lec.; 3 cr.

77. UNIT OPERATIONS LABORATORY. Experiments based upon the unit operations are performed on typical chemical engineering equipment. Mr. Lavine. *Prereq.*: Unit Operations. 3 lab.; 3 cr.

78. CHEMICAL PLANT DESIGN. The design and layout of chemical plants and equipment. The assigned problems are of a practical nature, such as the manufacture of some chemical product, and their solution will include the design or selection of all equipment and drawings of equipment, plant, and layout. Mr. Lavine. *Prereq.*: Unit Operations. 3 lab. 3 cr.

79. CHEMICAL ENGINEERING THERMODYNAMICS. A study of the fundamental laws of energy and their application to chemical engineering problems. Mr. Zimmerman. *Prereq.*: Physical Chemistry. 3 lec.; 3 cr.

80. CHEMICAL ENGINEERING PROJECT. In this course each student selects a research problem which he carries out independently under Faculty supervision. Intensive study in both the library and the laboratory and a satisfactory thesis at the completion of the work are required. Mr. Zimmerman or Mr. Lavine. *Prereq.*: Unit Operations Laboratory. 5 lab.; 5 cr.

135. UNIT OPERATIONS — FLUID FLOW, HEAT FLOW, AND EVAPORATION. An advanced course dealing with the fundamental theory and applications of these operations. Mr. Zimmerman. *Prereq.*: Elementary Unit Operations. 2 lec. or rec.; 2 cr.

136. UNIT OPERATIONS — DIFFUSION OPERATIONS. An advanced study of the principles of diffusion and their application to the unit operations of distillation, absorption, drying, humidification, and extraction. Mr. Zimmerman. *Prereq.*: Elementary Unit Operations. 2 lec. or rec.; 2 cr.

137, 138. UNIT PROCESSES. A study of the more recent developments in pyrolysis, oxidation, chlorination, nitration, and other unit processes. Mr. Zimmerman. *Prereq.*: Elementary Unit Processes, Organic Chemistry, and Physical Chemistry. 2 lec.; 2 cr.

139. CHEMICAL ENGINEERING THERMODYNAMICS. A study of recent developments in thermodynamics with particular emphasis on low-temperature and high-pressure processes. Mr. Zimmerman. *Prereq.*: Elementary Chemical Engineering Thermodynamics. 2 lec.; 1 rec.; 3 cr.

141, 142. THESIS — PROBLEMS IN CHEMICAL ENGINEERING. Independent investigations in some phase of chemical engineering. Mr. Zimmerman. *Prereq.*: Special permission. Credits to be arranged.

## CHEMISTRY

HAROLD A. IDDLES, *Chairman*

Admission to graduate study for the M.S. and Ph.D. degrees in chemistry requires the usual undergraduate courses in general chemistry, analytical chemistry, organic chemistry, and physical chemistry with the supporting courses in mathematics and physics.

Entering graduate students are expected to take proficiency tests in the four fields of chemistry to assist the guidance committee in starting the new student's graduate work at the proper level. Normally the residence requirements will consist of one academic year for the M.S. degree and a total of three academic years for the Ph.D. degree. The candidate will be expected to demonstrate proficiency in reading a foreign language, German for the M.S. candidate and German and one other language for the Ph.D. candidate. He will also demonstrate to the Doctoral Committee that he has a broad basic knowledge of the field of chemistry by means of a series of cumulative examinations and the submission and defense of two potential research proposals. Finally he will demonstrate the aptitude and ability to accomplish an original research project which will constitute the dissertation.

55-56. STRUCTURAL AND THEORETICAL PROBLEMS OF MODERN ORGANIC CHEMISTRY. An intensive study of the methods of preparation and reactions of the principal classes of organic compounds. Emphasis is on the working of assigned problems. The

electron theory of organic chemistry is used to correlate these reactions. The variation in reactivity of these various classes of organic compounds is utilized as a method of characterization of organic compounds. Emphasis is on the solution of assigned problems. Mr. Lyle. *Prereq.*: One year of organic chemistry. 3 lec. First semester; 1 lec. and 2 labs. Second semester; 3 cr.

62. ADVANCED METHODS OF QUANTITATIVE ANALYSIS. The theory and technique of special and recently developed methods of analysis such as colorimetry, turbidimetry, potentiometry, and spectrography. Sufficient experience is obtained to allow the development of considerable skill in even the more complex methods. Mr. Millard. *Prereq.*: Elementary Quantitative Analysis. 2 lec.; 2 lab.; 4 cr.

83-84. ELEMENTARY PHYSICAL CHEMISTRY. The properties of gases, liquids, and solids; thermochemistry and thermodynamics; solutions, chemical equilibria, reaction rates, conductance and electromotive force. Mr. Wheeler. *Prereq.*: Quantitative Analysis, Calculus, Physics. 3 lec.; 2 lab.; 5 cr.

85, 86. ADVANCED PHYSICAL CHEMISTRY. A review of selected topics in elementary physical chemistry followed by a study of the structure and properties of matter. Mr. Millard. *Prereq.*: One year of Physical Chemistry. 3 lec.; 3 cr.

101-102. ADVANCED ORGANIC CHEMISTRY. An advanced study of the reactions of organic compounds and the theories of organic chemistry. Mr. Kuivila. *Prereq.*: A year's course in Organic Chemistry. 3 lec.; 3 cr.

103-104. ADVANCED INORGANIC CHEMISTRY. The study of inorganic chemistry from the standpoint of modern ideas of atomic and molecular structure; the nature of the chemical bond; co-ordination compounds. Mr. Haundler. *Prereq.*: Undergraduate General and Physical Chemistry. 3 lec.; 3 cr.

105-106. ADVANCED PHYSICAL CHEMISTRY. A comprehensive study of physical chemistry from the standpoint of theory, experimental methods and applications of both to chemical problems. Mr. Millard. *Prereq.*: Undergraduate Physical Chemistry. 3 lec.; 3 cr.

111. ORGANIC CHEMISTRY. The chemistry of the polynuclear compounds and heterocyclic systems. Mr. Lyle. 3 lec.; 3 cr.

112. ORGANIC CHEMISTRY. The chemistry of natural products. Mr. Lyle. 3 lec.; 3 cr.

115. ORGANIC QUALITATIVE ANALYSIS. The reactions and properties of organic compounds. Use of group reactions in the identification of organic substances. Mr. Lyle. 1 lec.; 2 to 4 lab.; 3 to 5 cr.

116. ORGANIC MICRO-QUANTITATIVE ANALYSIS. Estimation of carbon and hydrogen by combustion, Dumas nitrogen, Kjeldahl nitrogen, estimation of halogens, of sulphur, and of organic radicals. Mr. Iddles. 1 lec.; 2 lab.; 3 cr.

117. STEREOCHEMISTRY. A brief review of the structural theory of organic chemistry is followed by a discussion of stereoisomerism including methods of determining configuration, resolution, and applications in the study of reaction mechanisms. Mr. Kuivila. *Prereq.:* Structural and Theoretical Problems of Modern Organic Chemistry or equivalent. 3 lec.; 3 cr.

118. REACTION MECHANISMS. Molecular rearrangements, tautomerism, and a few other important reactions are discussed with emphasis on the mechanisms involved. Mr. Kuivila. *Prereq.:* Stereochemistry is recommended but not required. 3 lec.; 3 cr.

121. PHYSICAL CHEMISTRY — CHEMICAL THERMODYNAMICS. Review of the first law of thermodynamics. Extension of it to systems more commonly studied in physics. The second and third laws. Applications of all three laws to homogeneous and heterogeneous systems, especially to non-ideal solutions, galvanic cells, and solutions of electrolytes. Statistical thermodynamics. Mr. O'Loane. *Prereq.:* One year of Physical Chemistry. 3 lec.; 3 cr.

122. PHYSICAL CHEMISTRY — CHEMICAL KINETICS. A study of the kinetics of homogeneous and heterogeneous reactions in gaseous and liquid systems, including an introduction to photochemistry. Mr. Daggett. *Prereq.:* One year of Physical Chemistry. 3 lec.; 3 cr.

124. ADVANCED PHYSICAL CHEMISTRY LABORATORY. The more modern experimental technique of physical chemistry. Emphasis on the needs and interests of each individual student. Topics will include the measurement of refractive index, molecular rotation, activity coefficients by vapor pressure and E.M.F. methods, heterogeneous and homogeneous equilibrium constants, and kinetic constants. Mr. O'Loane. 1 lec.; 2 lab.; 3 cr.

#### 131-132. COLLOQUIUM IN CHEMISTRY.

- a. Advanced Inorganic Chemistry, Mr. Haundler.
- b. History of Chemistry, Mr. Funkhouser.
- c. Organic Chemistry, Mr. Lyle.

- d. Theoretical Organic Chemistry, Mr. Kuivila.
- e. Organic Chemistry, Mr. Iddles.
- f. Physical Chemistry, Mr. O'Loane.
- g. Physical Chemistry, Mr. Millard.
- h. Physical Chemistry, Mr. Wheeler
- i. Analytical Chemistry, Mr. Daggett.

3 lec.; 3 cr. Sections of the course may be taken to a total of 12 cr.

141-142. SEMINAR. Presentation and discussion of recent investigations in the field of chemistry. 1 cr.

151, 152. THESIS PROBLEMS IN CHEMISTRY. Conferences, library, and experimental work in some field of chemistry. Analytical Chemistry and Photochemistry, Mr. Daggett; Inorganic Chemistry, Mr. Haundler; Organic Chemistry, Mr. Iddles, Mr. Funkhouser, Mr. Kuivila, and Mr. Lyle; Physical Chemistry, Mr. O'Loane, Mr. Millard, Mr. Wheeler. *Prereq.:* Special permission. Credits to be arranged.

## CIVIL ENGINEERING

EDMOND W. BOWLER, *Chairman*

In addition to the general requirements for all Graduate Students, students admitted to graduate study in Civil Engineering must present evidence of undergraduate training equivalent to that given to candidates for the Bachelor of Science Degree in this department.

103-104. SOIL MECHANICS. The physical and mechanical properties of soil in relation to engineering structures. The theory of consolidation, shearing resistance, bearing capacity, settlement, and earth pressure. 3 lec.; 3 cr.

105. SOIL TESTING FOR ENGINEERING PURPOSES. Arranged to cover the essential soil tests for engineering purposes. Identification of soils, determination of water content, void ratio, specific gravity, grain size distribution, and Atterberg limits. Tests for the physical properties include: permeability, capillarity, compressibility, rate and magnitude of consolidation, and shearing resistance. Mr. Skelton. *Prereq.:* Soil Mechanics in parallel or as a prerequisite. 1 lec.; 3 lab.; 4 cr.

106. FOUNDATION ENGINEERING. Application of the principles of soil mechanics to selection of type of substructure, foundation construction methods, exploratory soil studies, stability analysis, earth dam and tunnel construction, and underpinning operations. Mr. Skelton. *Prereq.:* Soil Mechanics. 3 lec.; 3 cr.

**111-112. ADVANCED HYDRAULICS.** Dimensional analysis, dynamic similarity, mechanics of viscous fluids, fluid flow in pipes, non-uniform flow, alternate stages of flow in open channels, hydraulic jump, and their application to engineering practice. Mr. Bowler. *Prereq.:* Hydraulic and Sanitary Engineering. 3 rec.; 3 cr.

**113-114. EXPERIMENTAL HYDRAULICS.** Experimental techniques and laboratory practice. Experimental studies of the fundamental phenomena of liquid flow. Mr. Dawson. *Prereq.:* Fluid Mechanics. 3 cr.

**115-116. ADVANCED HYDRAULIC AND SANITARY ENGINEERING.** Hydrology, hydraulics of river flow, flood flows, design of reservoirs, flood control, river control, and hydraulic and sanitary structures. Mr. Bowler, Mr. Dawson. *Prereq.:* Hydraulic and Sanitary Engineering. 3 rec.; 3 cr.

**121-122. ADVANCED STRUCTURAL ANALYSIS AND DESIGN.** Theories of structural action and their application to the design of complex structures, such as elevated water storage tanks, high buildings, continuous bridges, elastic arches, cantilever and swing bridges, and hydraulic structures. Mr. Alling. *Prereq.:* Structural Theory and Design. 3 rec.; 3 cr.

**123. INDETERMINATE STRUCTURES.** The analysis of continuous beams, rigid frames, and redundant trusses by classical and modern methods, such as elastic weights, method of work, slope deflection, moment distribution, and column analogy. Use of influence lines for analyzing indeterminate and continuous structures. Mr. Alling. *Prereq.:* Structural Theory. 3 rec.; 3 cr.

**124. PROBLEMS IN STRUCTURAL ENGINEERING.** Investigation of selected problems in the analysis and design of structural members. Some choice in topics, subject to the approval of the instructor. Mr. Alling. *Prereq.:* Structural Theory and Design. 3 rec.; 3 cr.

**129-130. THESIS.** Hours and credits from 6 to 9 are to be arranged.

## ECONOMICS

ARTHUR W. JOHNSON, *Chairman*

Graduate work is offered in Economics leading to the Degree of Master of Arts.

Admission to graduate study in Economics is limited to students with a satisfactory undergraduate record. The prerequisite for graduate work consists of a minimum of 24 hours of undergraduate work in Economics and related fields of which at least

12 hours shall have been in Economics. The Economics requirement includes a year's work in Principles of Economics.

The candidate for a Master's Degree must fulfill the general requirements of the Graduate School and the following departmental requirements: 18 semester hours in the Department of Economics in courses numbered above 100; a thesis, which may fulfill a maximum of six semester hours of the course requirements numbered above 100. The remaining twelve semester hours may be in the Department of Economics, in courses numbered above 50, or, with the consent of the major adviser, a maximum of nine semester hours will be accepted in courses numbered above 50 in related departments.

The thesis must be in form for presentation to the reading committee by May 1 of the year in which the degree is to be granted.

51. LABOR PROBLEMS. Historical background and present status of labor organizations and problems. Labor-management relations and collective bargaining; economics of wages and employment; case studies. Mr. Hogan. *Prereq.:* Principles of Economics. 3 lec. or rec.; 3 cr.

52. PUBLIC FINANCE. Economic analysis of public expenditures, collection of public revenues, and debt policies of federal, state, and local governments; evaluation of practices and techniques in financial administration of governments; analysis of taxation problems in the State of New Hampshire and New England. Mr. Katz. *Prereq.:* Principles of Economics. 3 lec. or rec. 3 cr.

53. MONEY AND BANKING. Study of the monetary and banking system with reference to monetary standards, value of money, commercial and non-commercial banking, and structure and policy of the Federal Reserve System. Mr. Degler. *Prereq.:* Principles of Economics. 3 lec. or rec.; 3 cr.

54. ADVANCED MONEY AND BANKING. Advanced monetary theory and some of the more practical aspects of modern banking. Mr. Degler. *Prereq.:* A satisfactory average in Money and Banking. 3 lec. or rec.; 3 cr. (Alternate years; offered in 1954-55.)

55. CORPORATIONS. Study of the forms of business organization with special emphasis on the corporate system, combination, and concentration. Mr. Degler. *Prereq.:* Principles of Economics. 3 lec. or rec.; 3 cr.

56. CORPORATION FINANCE. Study of corporate securities, methods of financing, and financial policy. Mr. Degler. *Prereq.:* Principles of Economics. 3 lec. or rec.; 3 cr.

58. PRINCIPLES OF INVESTMENT. The general principles of investment. The problem of investment; investment characteristics of stocks and bonds; public utility, railroad, industrial, and government securities; protection of the investor; investment banking; and related problems. Mr. Degler. *Prereq.*: Principles of Economics. 3 lec. or rec.; 3 cr. (Alternate years; not offered in 1954-55.)

63. INTERNATIONAL TRADE. Theory of international trade, foreign exchange, balance of international payments, tariffs and protection; the economic aspects of international relations with particular reference to recent policies. Miss Woodruff. *Prereq.*: Principles of Economics. 3 lec. or rec.; 3 cr.

64. COMPARATIVE STUDY OF ECONOMIC SYSTEMS. An examination of socialism, communism, capitalism, and modifications of these types, particularly as exemplified by leading nations. *Prereq.*: Principles of Economics or permission of the instructor. Miss Woodruff. 3 lec. or rec.; 3 cr.

66. LABOR LAW. Principles of labor law and legislation. *Pre-req.*: Econ. 2 or Govt. 2. 3 lec. or rec.; 3 cr. (Formerly Govt. 61 and Econ. 61.)

73. VALUE AND DISTRIBUTION. An advanced course in economic theory. Emphasis is upon the theory of price and the distribution of income. Mr. Shafer. *Prereq.*: Principles of Economics. 3 lec. or rec.; 3 cr.

74. THE ECONOMICS OF CONTEMPORARY AMERICAN BUSINESS. The nature of business profits as molded by accounting; survey of the mechanisms yielding profits including producing and inventory accumulation, credit expansion, net capital formation, etc.; the effects of these upon inflation, the value of money, labor management problems, the desire for tariffs, business cycles, farm problems, high-pressure selling, and other economic problems of the times; some evaluation of Neo-Classical and Keynesian schools of economic thought. Mr. Shafer. *Prereq.*: Principles of Economics. 3 lec. or rec.; 3 cr.

151, 152. LABOR SEMINAR. Advanced study of labor markets, wage incentive systems, job evaluation, relation of wage policy to employment and problems raised by these and other factors in negotiating collective bargaining contracts. Collective bargaining studied as a means of establishing a system of industrial jurisprudence. Class discussion based primarily on case studies. Mr. Hogan. 3 lec. or rec.; 3 cr.

157-158. HISTORY OF ECONOMIC THOUGHT. A critical study of the development of economic concepts and ideas. Attention is

given to the various schools of economic thought. Mr. Shafer. *Pre-req.*: 18 hours of major credit in Economics and the consent of the instructor. 3 lec. or rec.; 3 cr.

177. INSTITUTIONALISM. The institutional approach in economic analysis; the theory of conflicts of interest, scarcity, and mutuality; theory of transactions; efficiency in relation to scarcity; futurity; habit and custom; sovereignty and legal foundations; reasonable value; some examination of the works of Locke, Hume, Veblen, Commons, Mitchell, Nourse, and others. Mr. Shafer. *Pre-req.*: 18 hours of major credits in Economics and the consent of the instructor. 3 cr.

181, 182. READING AND RESEARCH IN ECONOMICS. With the advice and consent of the instructor, a student prepared by training and experience to do independent work may register for a reading and research course. The student will undertake assigned problems and readings under the guidance of the instructor. Hours and credits by arrangement.

- A. Economic History, Miss Woodruff
- B. International Trade, Miss Woodruff
- C. Economic Theory, Mr. Shafer
- D. Labor Economics, Mr. Hogan
- E. Public Finance, Mr. Katz
- F. Money and Banking, Mr. Degler
- G. Corporations, Mr. Degler
- H. Accounting Theory, Mr. Johnson
- I. Marketing, Mr. Korbel

THESIS. 6 cr.

## EDUCATION

THOMAS O. MARSHALL, *Chairman*

For admission to graduate study in Education, a student must present, in addition to a Bachelor's Degree, evidence of having satisfactorily completed either an undergraduate major in Elementary Education or (a) a year of Educational Psychology or its equivalent, (b) 18 semester credits in a teaching major subject, and (c) 12 semester credits in a first teaching minor subject.

For the Degree of Master of Education 30 credits must be earned. Areas in which competence must be demonstrated by all students are treated by the following courses.

1. *Either*  
Ed. 52. PRINCIPLES OF AMERICAN SECONDARY EDUCATION.  
*or*  
El. Ed. 95. WORKSHOP IN PRINCIPLES AND PRACTICES OF ELEMENTARY EDUCATION.
2. *Either*  
Ed. 58 or 160. PRINCIPLES AND PROBLEMS OF TEACHING IN SECONDARY SCHOOLS.  
*or*  
El. Ed. 98. WORKSHOP IN ELEMENTARY CURRICULUM PROBLEMS.
3. *Either*  
Ed. 91-92. PROBLEMS IN TEACHING THE MAJOR SUBJECT.  
*or*  
El. Ed. 90. WORKSHOP IN READING AND THE OTHER LANGUAGE ARTS.
4. Ed. 65. EDUCATIONAL TESTS AND MEASUREMENTS. (Emphasis should be upon the interpretation of tests and measurements.)
5. Ed. 176. PHILOSOPHY OF EDUCATION.
6. Psych. 89. MENTAL HYGIENE FOR TEACHERS.

Students who meet the requirements described are free to select, with the advice of the Chairman of the Department of Education, the remainder of their work required for the degree from Education and subject-matter courses arranged to secure most effective preparation for the professional work they desire to pursue. Students will be able to choose from a variety of courses designed to be helpful to students who are interested in increasing their teaching efficiency in the elementary school and the junior high school, as well as in the senior high school, to teachers and administrative officers who are interested in educational and vocational guidance, to teachers and administrative officers who are interested in physical education activities, and to educational administrators and teachers who are preparing to enter fields of administration or supervision.

Near the end of thirty semester hours of work the candidate for the Master's degree in Education begins writing, with the help of the Chairman of the Master of Education Degree Committee, a group of statements which are his own stand on basic issues in education. The aim of the writing of these statements is to help the candidate to pull together the ideas and points of view he has taken from course work into his own consistent and working philosophy of education. When he finishes his courses and the writing of the statements, he defends these statements in an oral examination.

52. (52). PRINCIPLES OF AMERICAN SECONDARY EDUCATION. The development and place of the secondary school in the American system of education; aims and functions of secondary education in our democracy; upward and downward extension of secondary education; articulation with lower and higher educational institutions, and with the community; the secondary-school pupil; adjustment of the work of the school to meet individual needs; the offerings, both curricular and extra-curricular, of the secondary school; place and relationships of school board, superintendent, headmaster, and teachers. Mr. Kehoe, Mr. Koch, and Mr. Marshall. 2 or 3 cr.

58. (58). SECONDARY SCHOOL TEACHING. This course is designed to help prospective teachers analyze the problems of junior and senior high-school teaching. It emphasizes the role of objectives, lesson preparation, and evaluation. Mr. Kehoe. *Prereq.*: Permission of the instructor. 2 or 4 cr.

63. (63). AUDIO-VISUAL MATERIALS IN THE ELEMENTARY AND SECONDARY SCHOOLS. A course intended to give teachers a practical working knowledge of the use of various types of audio-visual aids. The following aids will receive particular attention: the school journey, the school museum, silent and sound films and projectors, strip films and projectors with and without sound disc, transcriptions, and radio broadcasts. The course will be centered around the problems which are common to the use of audio-visual aids in both elementary and secondary schools. A laboratory period of one hour each week, in addition to the regular class period, is required. Efforts will be made to arrange the laboratory time to meet the need of the student. Mr. Olney. 2 or 3 cr.

65. (65). EDUCATIONAL TESTS AND MEASUREMENTS. The nature of measurement. Classification and evaluation of tests. Standardized tests in subject-matter fields. Diagnosis and prognosis of pupils' aptitudes, achievement, attitudes, and interests in the public-school program with particular emphasis upon the role of tests. Mr. Smith. *Prereq.*: Educational Psychology. 2 or 3 cr.

83. (83) PRINCIPLES AND PRACTICES OF GUIDANCE. A first course on the principles and practices of guidance for teachers and administrators who are participating or planning to participate in a program of guidance. It will include the study of different philosophies of guidance, orientation, individual and group counseling, and the securing and recording of information. Mr. Menge. *Prereq.*: Educational Psychology. 2 or 3 cr.

87. PRINCIPLES AND PROBLEMS OF SECONDARY-SCHOOL CURRICULUM REORGANIZATION. The course will be concerned with significant changes in secondary-school offerings, with special emphasis

upon curriculum revision and techniques of revision. Mr. Koch.  
2 or 3 cr.

102, (102). PUBLIC SCHOOL ADMINISTRATION. This course is intended for Graduate Students who have had teaching or administrative experience, and are looking forward to further work as superintendent, principal, or department head. Emphasis will be placed upon the practical application of the following functions of public-school administration: policy making, management, personnel, public relations, fiscal, housing, curricular, reportorial, research. Pursuit of practical term projects will be encouraged as well as having experience in attacking problems in school administration as buildings, budget, evaluating school housing, developing a schedule, etc. 2 or 3 cr.

111-112. WORKSHOP IN ADMINISTRATION IN THE JUNIOR AND SENIOR HIGH SCHOOLS. This course will be devoted to a study of basic principles of educational administration with their application to the following types of problems in the junior and senior high schools: the internal organization of the school, administering the program of studies, direction of extra-curricular activities, organization and direction of guidance, making the school schedule, selection of the staff, discipline and control, buildings and grounds, equipment and supplies, office organization, records and reports, administering finance, public relations and publicity. The course will be so organized as to permit students to specialize on problems of administration in the junior high school as well as in the senior high school. As the workshop technique of discussing practical problems will be utilized in the course, it is hoped that members of the group will bring problems for further discussion and study. Designed for individuals preparing for positions as principals and headmasters. 6 cr.

114, (114). WORKSHOP IN SECONDARY-SCHOOL CURRICULUM DEVELOPMENT. This course will be devoted to a study of the techniques and procedures of curriculum development for the purpose of better meeting the educational needs of adolescent youth. 2 or 3 cr.

118, (118). ORGANIZATION AND ADMINISTRATION OF GUIDANCE. An advanced course for teacher-counselors, counselors, and administrators who are interested in planning or reorganizing a guidance program. Emphasis will be placed on the programs of small high schools. 2 or 3 cr.

122, (122). PROBLEMS IN THE SUPERVISION OF HIGH-SCHOOL TEACHING. Consideration of the objectives of education, the objectives of supervision, and the role of supervisor in studying and

(Continued on Page 51)

# Campus Map Legend

(The map will be found on the next two pages.)

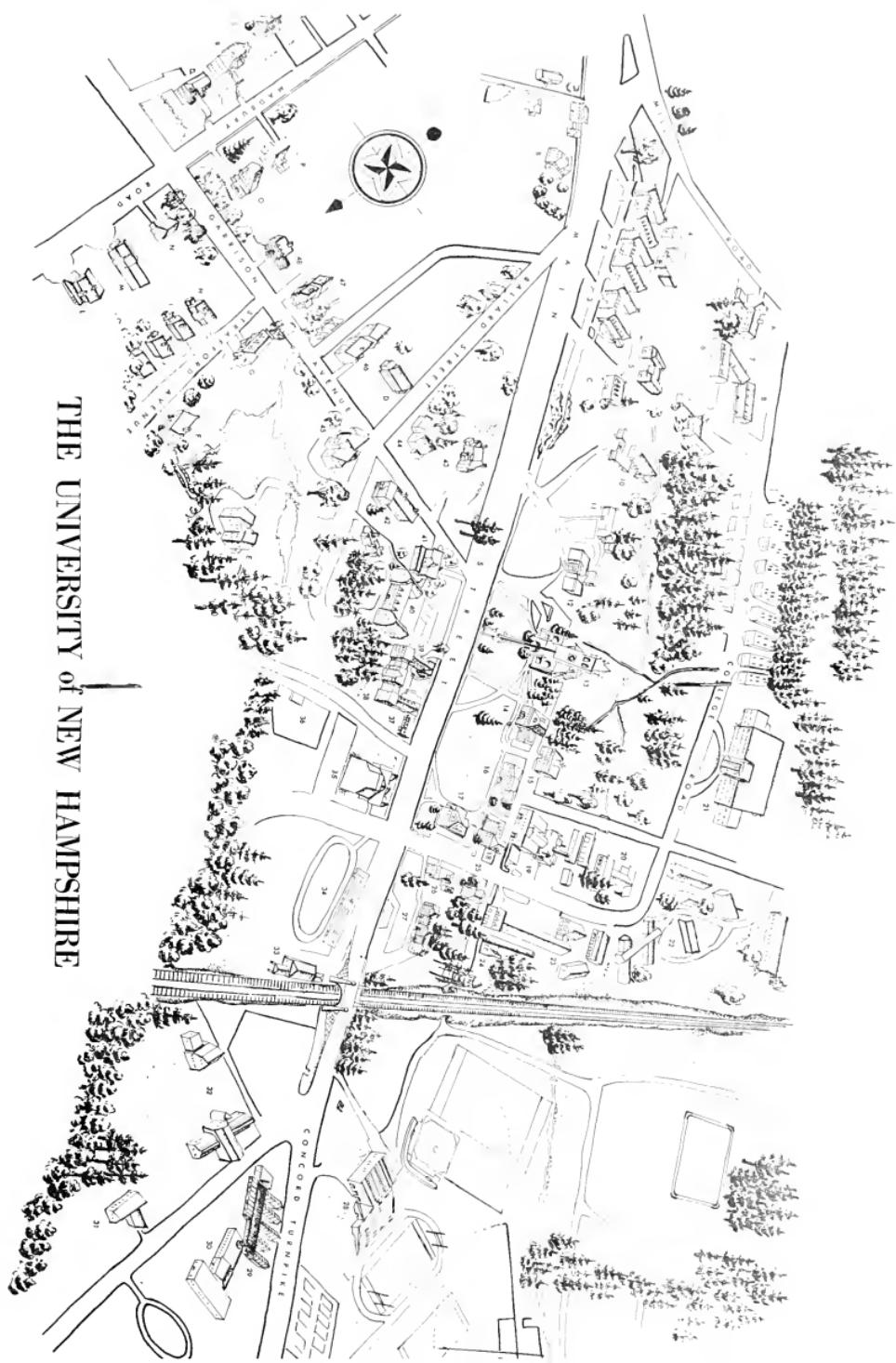
## UNIVERSITY BUILDINGS

- 1 Hetzel Hall, men's dormitory
- 2 Fairchild Hall, men's dormitory
- 3 Commons, dining hall and University Extension Service
- 4 Alexander Hall, men's dormitory
- 5 East and West Halls, men's dormitories
- 6 Engelhardt Hall, men's dormitory
- 7 Hunter Hall, men's dormitory
- 8 Gibbs Hall, men's dormitory
- 9 College Road Apartments, quarters for married students
- 10 Notch Hall, temporary student recreation center
- 11 Hood House, an out-patient clinic hospital for students
- 12 Hamilton Smith Library
- 13 Thompson Hall, administration, Bookstore, and Cooperative Extension Service
- 14 Murkland Hall, main building of the College of Liberal Arts; includes a 360-seat auditorium with an organ
- 15 Conant Hall, geology, geography, psychology, and hotel administration departments in Liberal Arts
- 16 DeMeritt Hall, history and sociology in Liberal Arts; mathematics and physics in Technology
- 17 Morrill Hall, headquarters of the College of Agriculture; government and economics in Liberal Arts
- 18 James Hall, chemistry in Technology; agricultural and biological chemistry in Agriculture
- 19 Hewitt Hall, art, photography, and occupational therapy in Liberal Arts; audio-visual center; printing and mailing departments
- 20 Forestry Building, forestry in Agriculture
- 21 Kingsbury Hall, main building of the College of Technology; departments of chemical, civil, electrical, and mechanical engineering; Engineering Experiment Station
- 22 Poultry Plant, six buildings devoted to research and instruction
- 23 Service Buildings, maintenance shops and garages, storage rooms, and fire station
- 24 Power Plant, heating facilities for all University buildings
- 25 Pettee Hall, ROTC divisions; home economics and agricultural engineering in Agriculture
- 26 Dairy Building, dairy husbandry in Agriculture; manufacture and processing of ice cream and milk; animal metabolism laboratory
- 27 Nesmith Hall, agronomy, animal husbandry, botany, entomology, horticulture, and poultry husbandry in Agriculture; bacteriology and biology in Liberal Arts

(Continued on Page 50)



THE UNIVERSITY of NEW HAMPSHIRE



# Campus Map Legend

(Continued from Page 47)

## UNIVERSITY BUILDINGS

28	Lewis Fields, men's athletic plant, including field house, Cowell stadium, Brackett field (baseball), hockey rink, tennis courts, and other playing fields	37	Faculty Club
38	North Congreve Hall, women's dormitory	39	South Congreve Hall, women's dormitory
29	Greenhouses	40	Scott Hall, women's dormitory
30	Putnam Hall, Thompson School; livestock and judging pavilion	41	Smith Hall, women's dormitory
31	Riding Stable	42	Sawyer Hall, women's dormitory
32	Livestock Barns, two of several used in Agriculture	43	President's House
33	Railroad Station, Boston and Maine Boston-Portland division	44	Alumni House, offices of Alumni Association; rooms for visiting alumni and guests
34	Memorial Field, women's athletics	45	Ballard Hall, music in Liberal Arts; offices for student publications
35	New Hampshire Hall, women's athletics; 1,000-seat hall used for convocations, lectures, concerts, drama; United Protestant Association offices	46	Schofield Hall, women's dormitory
36	Swimming Pool, an outdoor pool	47	Pettee House, residence for employees
		48	Practice House, home economics laboratory in Agriculture

## FRATERNITIES AND SORORITIES

A.	Acacia, men	K.	Kappa Delta, women
B.	Alpha Tau Omega, men	L.	Phi Delta Upsilon, men
C.	Kappa Sigma, men	M.	Phi Mu, women
D.	Theta Kappa Phi, men	N.	Phi Alpha, men
E.	Lambda Chi Alpha, men	O.	Alpha Chi Omega, women
F.	Chi Omega, women	P.	Theta Upsilon, women
G.	Alpha Xi Delta, women	Q.	Sigma Alpha Epsilon, men
H.	Alpha Gamma Rho, men	R.	Sigma Beta, men
I.	Tau Kappa Epsilon, men	S.	Phi Mu Delta, men
J.	Pi Kappa Alpha, men	T.	Theta Chi, men

evaluating the whole learning situation constitute the bases for the course. Emphasis will be placed upon the study of pupil and teacher diagnosis, pupil and teacher improvement, school material, and evaluation of supervising practices. Designed for headmasters, superintendents, and the supervisors of cadet teaching.

125, (125). EDUCATIONAL FINANCE AND BUSINESS MANAGEMENT. Aspects and principles of financing education, budgetary procedure, accounting, cost analysis, auditing school indebtedness, and financial reporting comprise the units to be studied. Experience in handling practical school finance problems will be part of the project work. *Prereq.:* A basic administration course or equivalent in course or experience. 2 or 3 cr.

131-132. RESEARCH PROBLEMS IN SECONDARY EDUCATION. 2 to 6 cr.

150, (150). ADVANCED EDUCATIONAL PSYCHOLOGY. An intensive study of special topics in the field of educational psychology with emphasis upon the learning process. The study will concern itself with the following: (a) examination of learning situations in the classroom in the light of experimental research; (b) examination and evaluation of learning situations in the light of the major theories of learning. Mr. Koch. *Prereq.:* Educational Psychology. 2 or 3 cr.

160, (160). ADVANCED PRINCIPLES AND TECHNIQUES OF SECONDARY TEACHING. The course will concern itself with the formulation of teaching objectives and with the selection of objectives in terms of essential criteria. Course organization will be emphasized in terms of objectives and criteria, and the problem technique will be developed to square with such organization. Students will be expected to work in their major areas of interest. Mr. Koch and Mr. Kehoe. *Prereq.:* For Graduate Students with teaching experience. 2 or 3 cr.

161, (161). PRINCIPLES AND PROBLEMS OF HIGHER EDUCATION. A course dealing with the purposes, external influences, internal administration, curriculum, student personnel, and faculty problems of colleges and universities. Mr. Blewett. 2 or 3 cr.

163, (163). METHODS OF COLLEGE TEACHING. A course to help, through reading and discussion, present and potential college teachers make their instruction more effective. Included in the topics which may be studied are types of teaching such as lecturing, recitation, etc.; psychology of learning; student aptitudes; organization of material; term papers and reports; examinations and grading; advising students; evaluation of teaching; and the professional status of college teachers. Mr. Sackett. 2 or 3 cr.

176, (176). **PHILOSOPHY OF EDUCATION.** A study of current educational objectives and practices and the philosophical foundations upon which they are based. Mr. Marshall. 2 or 3 cr.

### **Courses in Problems in Teaching High-school Subjects**

\*The following courses are devoted to a study of problems of objectives, selection, and organization of subject matter, teaching and testing techniques and classroom management in the teaching of the respective subjects. To be admitted into one of these courses the student must have completed, with a satisfactory grade, Principles and Problems of Teaching in the Secondary School, and, in addition, the courses in the subject and related subjects designated as prerequisites to the respective courses in this group. A student who desires to be considered for supervised teaching must complete with a satisfactory grade one of these courses in the subject in which he hopes to do supervised teaching.

**AGRICULTURE-EDUCATION (AG-ED) 92. PROBLEMS IN THE TEACHING OF HIGH-SCHOOL AGRICULTURE.** Mr. Barton. 3 cr.

**ART-EDUCATION (ART-ED) 91. PROBLEMS OF TEACHING ART IN ELEMENTARY SCHOOLS.** Mr. Thomas. 3 cr.

**ART-EDUCATION (ART-ED) 92. PROBLEMS OF TEACHING ART IN SECONDARY SCHOOLS.** Mr. Thomas. 3 cr.

**BIOLOGY-EDUCATION (BI-ED) 91. PROBLEMS IN THE TEACHING OF HIGH-SCHOOL BIOLOGY.** Mr. Moore. 3 cr.

**ENGLISH-EDUCATION (ENG-ED) 91. PROBLEMS IN THE TEACHING OF HIGH-SCHOOL ENGLISH.** Mr. Goffe. 3 cr.

**GENERAL SCIENCE-EDUCATION (GS-ED) 91. PROBLEMS IN THE TEACHING OF GENERAL SCIENCE.** 3 cr.

**HISTORY-EDUCATION (HIST-ED) 91. PROBLEMS IN THE TEACHING OF HIGH-SCHOOL HISTORY.** Mr. Long. 3 cr.

**HOME ECONOMICS-EDUCATION (HE-ED) 91. PROBLEMS IN THE TEACHING OF HIGH-SCHOOL HOME ECONOMICS.** Miss Turney. 3 cr.

**LANGUAGE-EDUCATION (LANG-ED) 91. PROBLEMS IN THE TEACHING OF FOREIGN LANGUAGES IN THE HIGH SCHOOL.** Mr. Siesicki. 3 cr.

**LATIN-EDUCATION (LAT-ED) 91, 92. PROBLEMS IN THE TEACHING OF HIGH-SCHOOL LATIN.** Mr. Walsh. 3 cr.

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\*For details concerning prerequisites and nature of these courses, see descriptions given under respective subject-matter departments.

**MATHEMATICS-EDUCATION (MATH-ED) 91. PROBLEMS IN THE TEACHING OF HIGH-SCHOOL MATHEMATICS.** Mr. Perkins. 3 cr.

**MUSIC-EDUCATION (MUS-ED) 91, 92. PROBLEMS IN THE TEACHING OF ELEMENTARY SCHOOL AND SECONDARY SCHOOL MUSIC.** Mr. Garretson. 3 cr.

**PHYSICAL EDUCATION (PE-ED.) 91. PROBLEMS IN THE TEACHING OF PHYSICAL EDUCATION FOR WOMEN.** Miss Newman. 4 cr.

### **Courses in Supervised Teaching**

Supervised Teaching is not open to a graduate of another institution unless he first completes an approved program of Teacher Preparation in the University.

Applications for Supervised Teaching must be filed in the office of the Department of Education at least four weeks before the date at which Supervised Teaching begins. These applications must be approved by the Chairman of the Department of Education and the Coordinator of Supervised Teaching. Applicants must complete Education 58, or its equivalent, and must have a sufficient background in a subject-matter field in which he is planning to teach. He must also complete a course in the problems of teaching in his major field. Supervised Teaching, as administered by the Department of Education, is a full-time job off campus for one semester.

Students may be enrolled for from 6 to 12 credits of work in Supervised Teaching in the second semester of the academic year. Students may count no more than 9 semester credits in Supervised Teaching toward the Master of Education degree.

**EDUCATION-AGRICULTURE (ED-AG) 93. SUPERVISED TEACHING IN HIGH-SCHOOL AGRICULTURE.** *Prereq.:* Senior standing in Ag-Ed Curriculum.

**EDUCATION-ART (ED-ART) 94. SUPERVISED TEACHING IN SECONDARY SCHOOL ART.** *Prereq.:* Art-Ed. 92.

**EDUCATION-BIOLOGY (ED-BI) 93, 94. SUPERVISED TEACHING IN HIGH-SCHOOL BIOLOGY.** *Prereq.:* Bi-Ed 91.

**EDUCATION-COMMERCE (ED-CO) 94. SUPERVISED TEACHING IN HIGH-SCHOOL COMMERCIAL SUBJECTS.**

**EDUCATION-ECONOMICS (ED-ECON) 94. SUPERVISED TEACHING IN HIGH-SCHOOL ECONOMICS.** *Prereq.:* Hist-Ed. 91

**EDUCATION-ENGLISH (ED-ENG) 94. SUPERVISED TEACHING IN HIGH-SCHOOL ENGLISH.** *Prereq.:* Eng-Ed 91.

**EDUCATION-LANGUAGE (ED-LANG) 94. SUPERVISED TEACHING IN HIGH-SCHOOL FRENCH.** *Prereq.:* Lang-Ed 91.

EDUCATION-GENERAL SCIENCE (Ed-GS) 94. SUPERVISED TEACHING IN GENERAL SCIENCE. *Prereq.:* GS-Ed 91.

EDUCATION-HISTORY (Ed-HIST) 94. SUPERVISED TEACHING IN HIGH-SCHOOL HISTORY. *Prereq.:* Hist-Ed 91.

EDUCATION-HOME ECONOMICS (Ed-HE) 94. SUPERVISED TEACHING IN HIGH-SCHOOL HOME ECONOMICS. *Prereq.:* HE-Ed 91.

EDUCATION-LATIN (Ed-LAT) 94. SUPERVISED TEACHING IN HIGH-SCHOOL LATIN.

EDUCATION-MATHEMATICS (Ed-MATH) 94. SUPERVISED TEACHING IN HIGH-SCHOOL MATHEMATICS. *Prereq.:* Math-Ed 91.

EDUCATION-MUSIC (Ed-MUS) 93, 94. SUPERVISED TEACHING IN ELEMENTARY AND SECONDARY SCHOOL MUSIC.

EDUCATION-PHYSICAL EDUCATION (Ed-PE) 93, (93). DIRECTED TEACHING IN PHYSICAL EDUCATION.

EDUCATION-PHYSICAL EDUCATION (Ed-PE) 94. SUPERVISED TEACHING OF PHYSICAL EDUCATION IN THE FIELD.

EDUCATION-SOCIOLOGY (Ed-Soc) 94. SUPERVISED TEACHING IN HIGH-SCHOOL SOCIOLOGY. *Prereq.:* Hist-Ed 91.

### **Elementary Education**

Courses in Elementary Education are normally given only during the Summer Session

67. CHILDREN'S LITERATURE. 1 cr.

68. THE TEACHING OF ELEMENTARY-SCHOOL SOCIAL STUDIES. 3 cr.

84. WORKSHOP IN INTERMEDIATE GRADE SUBJECTS AND PUPIL ORGANIZATION. 4 cr.

90. WORKSHOP IN READING AND OTHER LANGUAGE ARTS. 4 cr.

91. THE TEACHING OF ARITHMETIC. 3 cr.

93. THE TEACHING OF ELEMENTARY-SCHOOL SCIENCE. 3 cr.

94. ADMINISTRATION AND SUPERVISION OF THE ELEMENTARY SCHOOL. 4 cr.

95. WORKSHOP IN PRINCIPLES AND PRACTICES OF ELEMENTARY EDUCATION. 3 cr.

96. THE IMPROVEMENT OF READING. 3 cr.

98. WORKSHOP IN ELEMENTARY-SCHOOL CURRICULUM PROBLEMS. 3 cr.

## **ELECTRICAL ENGINEERING**

ALDEN L. WINN, *Chairman*

To be admitted to graduate study in Electrical Engineering a student should have completed work in his major field equivalent to that required of undergraduates at the University of New Hampshire. With the consent of the Department a student may be permitted to substitute approved course work for the thesis requirement. If a thesis is presented, one additional copy is required by the department.

Students who plan to take graduate work in Electrical Engineering are expected to consult with the department in order to plan their programs. Courses numbered below 100 are offered annually. Courses numbered above 100 are offered only by arrangement. Students desiring to take a specified course numbered above 100 must consult with the department chairman to determine if it can be offered.

51-52. INDUSTRIAL ELECTRONICS FUNDAMENTALS. E.E. 51: Principles of electronics and applications to industrial control processes. E.E. 52: Study of operation and testing of selected electronic control systems. *Prereq.:* Fundamentals of Electricity, or Electrical Machinery. Limited to students not registered in the Electrical Engineering Curriculum. 2 rec.; 1 lab.; 3 cr.

58. COMMUNICATION SYSTEMS. Analysis and design of the components of Communication Systems. Performance tests on receivers, transmitters, power amplifiers, and other elements of radio, television, carrier current, and speech amplifying systems. 3 rec.; 1 lab.; 4 cr.

59. ELECTRON TUBES AND DEVICES. Principles of electron devices and associated circuits. Emphasis on electronic instruments. *Prereq.:* Theory of Electricity and Magnetism, and Differential Equations. Limited to students not registered in the Electrical Engineering Curriculum. 3 rec.; 1 lab.; 4 cr.

60. ADVANCED CIRCUIT THEORY. Steady state and transient analysis, derivation of fundamental formulas and constants. 3 rec.; 1 conference period; 4 cr.; when offered without conference period, 3 cr.

70, (70). ADVANCED ELECTRONICS LABORATORY. Problems in design, analysis, construction, and testing, to be selected by the student. Permission to take this course will be given only upon acceptance and approval of an outline of the nature and extent of the work to be done, submitted by the prospective student. 1-3 lab.; 1 conference period; 2 to 4 cr.

78. INDUSTRIAL ELECTRONICS. Analysis and design of the electronic components used in industrial processes; performance tests on selected electronic apparatus such as motor controls, synchronizers, voltage regulators, induction and dielectric heating equipment, etc.; introduction to servomechanisms and synchros. 3 rec.; 1 lab.; 4 cr.

101, 102. ELECTRIC AND MAGNETIC CIRCUITS. A treatment of unbalanced circuits by the use of symmetrical components. Transformer and reactor analysis. 3 rec.; 3 cr.

103, 104. FIELDS AND WAVES. Electromagnetic fields and wave guides. 3 rec.; 3 cr.

105. PULSED CIRCUIT ANALYSIS. Analysis and design of pulsed circuits; investigation of systems which use pulsed circuit techniques. 3 rec.; 3 cr. *Prereq.:* Communication Systems.

106. ANTENNAS. Theory of antennas at radio, ultra-high, and micro-wave frequencies. *Prereq.:* Fields and Waves. 3 rec.; 3 cr.

107, 108. TRANSMISSION AND DISTRIBUTION OF ELECTRIC POWER. Line characteristics, lightning protection, grounding, re-laying, networks, application of network protectors, limiters, fuses, capacitors, and arresters. 3 rec.; 3 cr.

109, 110. ADVANCED NETWORK THEORY. Emphasis on communication networks; transmission lines, line sections and filters; use of charts for impedance matching; filters with lumped circuit elements; network synthesis. 3 rec.; 3 cr.

111-112. PRINCIPLES OF RADAR. Fundamental Principles of pulsed radar and supersonics, analysis of timing circuits, modulation indicators and receivers, RF transmission systems, resonant lines and cavities, microwave generators and switching tubes, application of synchros and servomechanisms. *Prereq.:* Differential Equations, Communications Systems. E.E. 111: 3 rec.; 3 cr. E.E. 112: 3 rec.; 1 lab.; 4 cr.

113-114. PRINCIPLES OF SERVOMECHANISMS AND CONTROL. General open-loop and closed-loop control. Transfer function concept. Steady-state and transient response, stability criteria; complex plan plots; attenuation and phase diagrams, design of feedback control systems. *Prereq.:* Differential Equations, Advanced Circuit Theory. E.E. 113: 3 rec.; 3 cr. E.E. 114: 2 lab. and seminar periods; 3 cr.

THESIS. Credits to be arranged. 6-10 cr.

## **ENGLISH**

**SYLVESTER H. BINGHAM, Chairman**

For admission to graduate study in English an applicant must present an academic record that shows he is prepared for advanced work in English and American literature. He must pass the written examination on English and American literature which is required of undergraduate majors in English unless he has previously passed it or its equivalent. This requirement must be fulfilled before beginning the thesis.

Special requirements for the Master's Degree: The student who is a candidate for a Master's Degree in English must earn 30 credits: no more than 12 in literature courses open to undergraduate students (those numbered 55-99); at least 12 in literature courses numbered 155-199; and 6 credits in a thesis.

A reading knowledge of French, German, or Latin is required of the candidate.

A student taking a course numbered 155-199 other than a seminar must register for the graduate course and pass, in partial fulfillment, with a grade of B or better, the corresponding undergraduate course numbered 55-99; at the same time he must do additional work assigned by his instructor and prepare a paper on an agreed subject which is connected with his study. An account of the additional work must be turned in to the Chairman of the Department no later than three weeks after the commencement of the course, and the paper must be in the hands of the Chairman at least one week before the end of the course. A student should not register for a graduate course if he has previously taken the corresponding undergraduate course.

If a student intends to complete his work for the master's degree in one year, he must register for 3 thesis credits each semester.

55, 56. CHAUCER. Mr. Call. 3 rec.; 3 cr.

57, 58. SHAKESPEARE'S PLAYS. The major histories, comedies, and tragedies. Mr. Hennessy. 3 lec.; 3 cr.

59. MILTON. Mr. Schultz. 3 lec.; 3 cr. (Alternate years; not offered in 1954-55.)

60. BOSWELL'S JOHNSON. Mr. Maynard. 3 lec.; 3 cr. (Alternate years; offered in 1954-55.)

61. WORDSWORTH. Mr. Call. 3 lec.; 3 cr. (Alternate years; offered in 1954-55.)

62. BROWNING. Mr. Daggett. 3 lec.; 3 cr. (Alternate years; not offered in 1954-55.)

63, 64. ENGLISH LITERATURE IN THE SIXTEENTH CENTURY. Mr. Schultz. 3 lec.; 3 cr. (Alternate years; offered in 1954-55.)

65, 66. ENGLISH LITERATURE IN THE SEVENTEENTH CENTURY. Mr. Towle. 3 lec.; 3 cr. (Alternate years; offered in 1954-55.)

67, 68. ENGLISH LITERATURE IN THE EIGHTEENTH CENTURY. Mr. Maynard. 3 lec.; 3 cr. (Alternate years; not offered in 1954-55.)

69, 70. THE ENGLISH ROMANTIC PERIOD. Wordsworth, Coleridge, Lamb, Byron, Shelley, Keats, Hazlitt, DeQuincey. Mr. Call. 3 lec.; 3 cr. (Alternate years; not offered in 1954-55.)

71, 72. VICTORIAN PROSE AND POETRY. Major non-fictional prose from Carlyle to Stevenson and major poetry from Tennyson to Hardy. Mr. Hennessy. 3 lec.; 3 cr. (Alternate years; offered in 1954-55.)

73, 74. BRITISH LITERATURE OF THE TWENTIETH CENTURY. Mr. Daggett. 3 lec.; 3 cr. (Alternate years; offered in 1954-55.)

75. NEW ENGLAND RENAISSANCE. Emerson, Thoreau, and other transcendentalists. Mr. Daggett. 3 lec.; 3 cr. (Alternate years; offered in 1954-55.)

76. AMERICAN NOVEL IN THE NINETEENTH CENTURY. Mr. Webster. 3 lec.; 3 cr. (Alternate years; not offered in 1954-55.)

77. AMERICAN POETRY OF THE NINETEENTH CENTURY. Mr. Daggett. 3 lec.; 3 cr. (Alternate years; not offered in 1954-55.)

79, 80. AMERICAN LITERATURE OF THE TWENTIETH CENTURY. Mr. Towle. 3 lec.; 3 cr. (Alternate years; not offered in 1954-55.)

81, 82. INTRODUCTION TO ENGLISH DRAMA. The development of English drama, exclusive of Shakespeare, from the Middle Ages to the present. Mr. Hennessy. 3 lec.; 3 cr. (Alternate years; not offered in 1954-55.)

83, 84. THE ENGLISH NOVEL OF THE EIGHTEENTH AND NINETEENTH CENTURIES. Mr. Bingham and Mr. Miller. 3 lec.; 3 cr.

155, 156. CHAUCER. 3 lec.; 3 cr.

157, 158. SHAKESPEARE. 3 lec.; 3 cr.

159. MILTON. 3 lec.; 3 cr. (Alternate years; not offered in 1954-55.)

160. BOSWELL'S JOHNSON. 3 lec.; 3 cr. (Alternate years; offered in 1954-55.)

161. WORDSWORTH. 3 lec.; 3 cr. (Alternate years; offered in 1954-55.)

162. BROWNING. 3 lec.; 3 cr. (Alternate years; not offered in 1954-55.)

163, 164. ENGLISH LITERATURE IN THE SIXTEENTH CENTURY. 3 lec.; 3 cr. (Alternate years; offered in 1954-55.)

165, 166. ENGLISH LITERATURE IN THE SEVENTEENTH CENTURY. 3 lec.; 3 cr. (Alternate years; offered in 1954-55.)

167, 168. ENGLISH LITERATURE IN THE EIGHTEENTH CENTURY. 3 lec.; 3 cr. (Alternate years; not offered in 1954-55.)

169, 170. THE ENGLISH ROMANTIC PERIOD. 3 lec.; 3 cr. (Alternate years; not offered in 1954-55.)

171, 172. VICTORIAN PROSE AND POETRY. 3 lec.; 3 cr. (Alternate years; offered in 1954-55.)

173, 174. BRITISH LITERATURE OF THE TWENTIETH CENTURY. 3 lec.; 3 cr. (Alternate years; offered in 1954-55.)

175. THE NEW ENGLAND RENAISSANCE. 3 lec.; 3 cr. (Alternate years; offered in 1954-55.)

176. THE AMERICAN NOVEL IN THE NINETEENTH CENTURY. 3 lec.; 3 cr. (Alternate years; not offered in 1954-55.)

177. AMERICAN POETRY OF THE NINETEENTH CENTURY. 3 lec.; 3 cr. (Alternate years; not offered in 1954-55.)

179, 180. AMERICAN LITERATURE OF THE TWENTIETH CENTURY. 3 lec.; 3 cr. (Alternate years; not offered in 1954-55.)

181, 182. AN INTRODUCTION TO ENGLISH DRAMA. 3 lec.; 3 cr. (Alternate years; not offered in 1954-55.)

183, 184. THE ENGLISH NOVEL OF THE EIGHTEENTH AND NINETEENTH CENTURIES. 3 lec.; 3 cr.

186. SEMINAR. Medieval Arthurian Romance. Mr. Call. 3 cr.

187. SEMINAR. Literature and Religious Philosophy, 1570 to 1670. Mr. Schultz. 3 cr.

THESIS. 6 cr.

## **ENTOMOLOGY**

JAMES G. CONKLIN, *Chairman*

For admission to graduate study in Entomology an applicant is expected to have had adequate preparation in undergraduate Entomology and related sciences. Students lacking the necessary background courses may be required to complete certain courses which do not carry graduate credit before they are admitted to candidacy for a degree.

The program of graduate study is designed to meet the needs of those students who are planning to take further work leading to a career in professional Entomology.

A thesis is required of all candidates for the Master's Degree in Entomology.

54. MEDICAL ENTOMOLOGY. Insects and arachnids in relation to public health. The more important disease carriers, their biologies, and means of control. Adapted especially for students who are interested in public health or medicine. Mr. Bickle. 2 lec.; 1 lab.; 3 cr.

56. FOREST INSECTS. Principles of Forest Entomology. Life histories and habits of the more destructive forest insects. Forest insect control. Adapted especially for forestry students. Mr. Conklin. *Prereq.:* Elementary Entomology. 1 lec.; 2 cr.

57-58. ADVANCED ENTOMOLOGY. The anatomy and physiology of insects. Systematic Entomology. Mr. Conklin, Mr. Bickle. Open to others than Entomology majors by permission of the Chairman of the Department. 2 lec.; 2 lab.; 4 cr.

59-60. ADVANCED ECONOMIC ENTOMOLOGY. Problems in applied Entomology. The literature of Economic Entomology. Investigational methods. Studies of the specialized phases of Entomology. Mr. Conklin, Mr. Bickle. Required of Entomology majors. Open to others than Entomology majors by permission of the Chairman of the Department. 1 to 3 cr.

101, 102. GRADUATE ENTOMOLOGY. Mr. Conklin, Mr. Bickle. Hours and credits to be arranged.

103, 104. GRADUATE ENTOMOLOGY. THESIS. Mr. Conklin, Mr. Bickle. Hours and credits to be arranged.

## **GOVERNMENT**

JOHN T. HOLDEN, *Chairman*

An applicant for admission to graduate study in Government must have completed 24 semester credits of work in the Social Sci-

ences including a minimum of 12 credits in Government with an average grade of B or the equivalent in his government courses.

A candidate for the degree of Master of Arts in Government is required to complete at least 30 credits of work with a minimum of 18 credits in Government courses numbered 101-199 including the thesis; at least 3 credits in Government courses numbered 51-99; and a maximum of 9 credits in courses offered by related departments and numbered 51 - 199.

51. **INTRODUCTION TO LAW.** A study of the nature, sources, and problems of the law as distinguished from other forms of social control. In its approach the course is analytical and critical, tracing the origin and development of legal institutions from primitive times to the present and evaluating the modern role of judge, jury, and counsel in the administration of justice. In this way emphasis is given to the law in action, i.e., law as it is applied by courts and practiced by lawyers rather than as it is formulated by the legislative and executive branches. Mr. Dishman. *Prereq.:* Permission of the instructor. 3 lec. or rec.; 3 cr.

52. **CONSTITUTIONAL LAW.** A case study of the American Constitution, stressing the basic constitutional principles on which the American political system is founded and their application to present-day social, political, and economic problems. In addition, emphasis will be given to the powers of Congress, the President, and the federal courts and to the constitutional limitations by which their respective powers are checked. Mr. Dishman. *Prereq.:* Permission of the instructor. 3 cr.

55. **WORLD POLITICS.** An analysis of the basic forces which influence the policies of nations toward one another. Recent developments will be discussed under such topics as the nature of power, nationalism, imperialism, ideology, propaganda, economic, political and military warfare, disarmament, and peace enforcement. The critical relationship between the United States and the U.S.S.R. will be given special emphasis. Mr. Kuusisto. 3 lec. or rec.; 3 cr.

56. **INTERNATIONAL LAW AND ORGANIZATION.** This course has a double aim: to analyze the rules governing the conduct of states and to examine existing international organizations, both within and outside the United Nations. An analysis of the United Nations and its subsidiary organizations, as well as the defunct League of Nations and its agencies, is made in terms of their effectiveness in bringing law and order to the international community. The policies of the Great Powers toward major issues of both international law and organization are examined. Mr. Kuusisto. 3 lec. or rec.; 3 cr.

57. PUBLIC ADMINISTRATION. An examination of the principle concepts of governmental administration, including theories of organization, management, administrative leadership, and administrative responsibility. Emphasis is placed upon the relationship of the administrative process to political behavior at the various levels of government. Elective for Government majors; Permission of the instructor or others. 3 lec. or rec.; 3 cr.

59. PROBLEMS OF PUBLIC ADMINISTRATION. Case studies of actual administrative situations, derived from federal, state, and local administrative experiences. Emphasis is placed upon the analysis of factors influencing administrative decision making in problems of management and policy development. Elective for Government majors; Permission of the instructor for others. 3 lec. or rec.; 3 cr.

60. GOVERNMENT APPRENTICESHIP. Designed to give the student a practical concept of local and state government administration. At least two afternoons a week will be spent working under the supervision of a public official in a unit of state or local government. The student will be assigned to the Bureau of Government Research service projects which are designed to assist the public official under whom the student is working. The student will be expected to acquaint himself with the instructional materials available in his field of apprenticeship. Periodic reports will be required. *Prereq.:* Public Administration and permission of the instructor. 4 cr.

63. POLITICAL THOUGHT IN THE WEST. A survey of the principal political theories from Plato and Aristotle to the beginning of the modern liberal tradition. The course is designed to show the growth and development of political thinking and institutions in terms of the development of modern government. Special emphasis will be given to the development of the modern nation state and to its fundamental institutions. Mr. Holden. 3 lec. or rec.; 3 cr.

64. MODERN POLITICAL THOUGHT. A survey of modern Western political thought from the emergence of the nation state to the present. Special attention will be given to the meaning and growth of the basic patterns of thought on the Continent and in England, including liberalism, democracy, socialism, communism, fascism, and nazism. American political thought will be traced from its English and European origins, stressing the more modern developments in federalism, judicial review, centralization, separation of powers, etc. Mr. Holden. 3 lec. or rec.; 3 cr.

65, 66. RESEARCH IN GOVERNMENT PROBLEMS. An individual research project in one of the fields of government, e.g., local or

state administration, comparative government, international relations, international organization, political theory, politics, or public law to be prepared under the direction of the instructor. Emphasis will be placed on the methods and sources of research in government. Mr. Dishman. 3 cr.

68. PUBLIC POLICY AND INDUSTRY. A study of Public Policy and the regulatory process on both the federal and state levels. The principal emphasis of the course is upon the ideological, legal, economic, political, and administrative aspects of public regulation. Formation of public policy and regulation by administrative agencies of selected industries form the core of the course. Mr. Dishman. *Prereq.:* Permission of the instructor. 3 lec. or rec.; 3 cr.

READING AND RESEARCH IN GOVERNMENT AND POLITICAL SCIENCE. With the advice and consent of the instructor, graduate students in social science who demonstrate the ability to do independent work may register for a reading and research course. The student will undertake assigned problems and readings under the guidance of the instructor. Hours to be arranged. 3 cr.

- 151. TOPICS IN PUBLIC POLICY, Members of Department Staff.
- 152. PARTY AND PRESSURE POLITICS, Mr. Dishman.
- 153. THE ADMINISTRATIVE PROCESS.
- 154. PROBLEMS IN AMERICAN DEMOCRACY, Mr. Dishman.
- 155. THE DEVELOPMENT AND ADMINISTRATION OF U. S. FOREIGN POLICY, Mr. Kuusisto.
- 156. THE JUDICIAL PROCESS, Mr. Dishman.
- 157. AMERICAN POLITICAL THOUGHT, Mr. Holden.
- 158. NINETEENTH CENTURY POLITICAL THEORY, Mr. Holden.
- 159. THE LEGISLATIVE PROCESS, Mr. Holden or Mr. Kuusisto.
- 160. TOPICS IN EUROPEAN POLITICS, Mr. Holden.
- 161. TOPICS IN FAR EASTERN POLITICS, Mr. Kuusisto.
- 162. TOPICS IN PUBLIC MANAGEMENT, Mr. Knapp.

THESIS. To be arranged. 6-9 cr.

## HISTORY

PHILIP M. MARSTON, *Chairman*

The candidate for admission to graduate study in History should present evidence of having satisfactorily completed at least 24 semester credits, as an undergraduate, in courses in History, not including courses open to Freshmen, with a grade of C or better. The requirements for the Degree of Master of Arts in History are those stated on page 16 of this announcement of the Graduate School. The completed thesis must be submitted by April 1 of the year in which the degree is to be granted.

**51, 52. COLONIAL AND REVOLUTIONARY AMERICAN HISTORY.** Colonial beginnings in America, national rivalries, the English colonies, the Revolution, and our national life to 1789. Early forms of Americanism in the making. Mr. Marston. 3 lec. or rec.; 3 cr. (Alternate years; offered in 1954-55.)

**59, 60. SOCIAL AND CULTURAL HISTORY OF NEW ENGLAND.** From the settlements to the present. The material and intellectual aspects peculiar to New England's social and cultural life. The viewpoint is partly that of the antiquarian. Source materials figure considerably. It is assumed that the student is familiar with the general history of New England. Mr. Marston. 3 lec. or rec.; 3 cr. (Alternate years; not offered in 1954-55.)

**65, 66. HISTORY OF THE NEAR EAST.** A study of the Ottoman Near East and its political fragmentation resulting from the rise and development of the Arab, Turkish, Zionist, and other nationalist movements with their effect upon the contemporary history of the Near East. The course is organized on a topical basis to provide students with the opportunity for wide reading on selected individual topics. Mr. Yale. *Prereq.:* Modern European History or permission of the instructor. 3 lec. or rec.; 3 cr.

**71, 72. HISTORY OF RUSSIA.** A study of Tsarist Russia, its domestic and foreign affairs, and its collapse in 1917; followed by a study of Soviet Russia from the creation of the Soviet Union to the present. Mr. Yale. *Prereq.:* Modern European History or permission of the instructor. 3 lec. or rec.; 3 cr.

**83, 84. THE FOREIGN RELATIONS OF THE UNITED STATES.** Although primarily a study in the history of American diplomacy, as much attention as possible is given to the non-diplomatic aspects of foreign relations. Mr. Long. 3 lec. or rec.; 3 cr. (Alternate years; offered in 1954-55.)

**85, 86. TWENTIETH CENTURY AMERICA.** A study of the history of the United States since 1890. Emphasis is placed on economic discontent and political protest from the Populist Revolt to date; and on the world conditions changing and molding United States foreign policy. Mr. Long. 3 lec. or rec.; 3 cr. (Alternate years; not offered in 1954-55.)

**87, 88. THE INTELLECTUAL HISTORY OF WESTERN CIVILIZATION.** The history of ideas and of great epochs in human thought. A study of the dominant characters of the leading cultures and of the transitions from one to the other. The content of the course will be selective rather than inclusive. Special attention will be given to a study of some of the major source writings of each period. Mr. Johnson. 3 lec. or rec.; 3 cr. (Not offered in 1954-55.)

**HISTORY-EDUCATION (HIST-ED). 91. PROBLEMS IN THE TEACHING OF HIGH-SCHOOL HISTORY AND OTHER SOCIAL STUDIES.** Bibliography and new interpretations of history; the social studies curriculum, past and present; aims and objectives in the social studies; selection and organization of teaching material; teaching and testing techniques. Special emphasis on teaching American History and the Problems of American Democracy. Mr. Long. Open to students who have satisfactorily completed History of the United States; six credits in other history courses, exclusive of Introduction to Contemporary Civilization; six credits from American Government, Principles of Economics or Principles of Sociology; and Principles and Problems of Teaching in the Secondary School. 3 lec. or rec.; 3 cr.

**111, 112. SEMINAR IN THE HISTORY OF NEW ENGLAND.** For Graduate Students who wish to specialize in some phase of New England history or the history of New Hampshire. The work is concerned primarily with the study and interpretation of source material and can be correlated with the preparation of a thesis. Mr. Marston. *Prereq.:* Permission of the instructor. 3 cr. (Alternate years; not offered in 1954-55.)

**113, 114. SOURCES FOR THE STUDY OF COLONIAL AMERICAN HISTORY.** For students who have taken Colonial and Revolutionary American History or the equivalent. Training in the methods of historical investigation and in the use of sources in the field of Colonial American History. The preparation of papers based on source materials alone. Mr. Marston. *Prereq.:* Permission of the instructor. 3 cr. (Alternate years; offered in 1954-55.)

**123, 124. HISTORIOGRAPHY.** The lives and writings of some leading historians from earliest times to the present, and their contributions to scope, method, viewpoint, and literary achievement. Mr. Partridge. *Prereq.:* Permission of the instructor. 3 cr.

THESIS. 6 cr.

## **HOME ECONOMICS**

**ANNA M. LIGHT, *Chairman***

Students admitted as candidates for the Master of Science degree in Home Economics, majoring in Nutrition, are expected to have completed a course of study equivalent to that required for the Bachelor of Science degree in Home Economics with a major in Foods and Nutrition at this University. However, students with good undergraduate records who have deficiencies in certain requirements may be admitted on condition that they complete specified courses without credit.

The candidate will be required to pass an oral examination and prepare a thesis. Thesis credits may be from 6-10 depending upon the research problem involved.

The subject-matter fields for graduate study in Nutrition are: Foods and Nutrition; Agricultural and Biological Chemistry or Bacteriology.

60. FLAT PATTERN. A study of the principles of developing designs from a basic pattern by the flat pattern method; and the development of original patterns and garments. Miss Ericson. *Prereq.*: H. E. 6. 2 3-hr. labs.; 3 cr.

61. TAILORING. A study of the principles of constructing tailored garments and the application of the principles through construction of a suit or coat. Miss Ericson. *Prereq.*: H. E. 6. 2 3-hr. labs.; 3 cr..

63. DRAPING. A study of the basic principles of fabric manipulation in the draping processes and the evolution of patterns and garments through this method. Miss Ericson. *Prereq.*: H. E. 6. 2-3 hr. labs.; 3 cr.

64. ADVANCED TEXTILES. An introduction to the chemical and physical testing of textiles and assigned readings of technical literature in the field. Miss Ericson. *Prereq.*: H. E. 3, Chem. 45, Physics 1, and Bact. 1. 1 lec. or rec.; 2 2-hr. labs.; 3 cr.

65. HISTORY OF COSTUME. A study of costume (and textiles) from primitive times to the present and the relationship of the mores of each period to the development of the costume for the respective era. *Prereq.*: Soc. 1 or Psych. 1 or Ed. 41, 42. (Recommended Hist. 1, 2.) 3 lec. or rec.; 3 cr.

66. COSTUME DESIGN AND FASHION ILLUSTRATION. The development of some skill in the delineation of fashion figures, and the sketching of original costume designs derived from various sources of inspiration. *Prereq.*: H. E. 6 and H. E. 65. 2 2-hr. labs.; 2 cr.

68. FUNDAMENTALS OF FASHION. A study of economical, psychological, and sociological problems inherent in the field of fashion. A survey of the development of the fashion industry. A study of the outstanding persons in the field. Miss Ericson. *Prereq.*: Econ. 25., B. Ad. 46, Psych. 2, and Soc. 1. 3 lec. or rec.; 3 cr.

69, (69). PROBLEMS IN CLOTHING AND TEXTILES. An opportunity for the mature student to investigate through independent study problems in the area of his special interests. Readings, research, or cooperatively administered experiences in industry or merchandising. Staff. For Seniors with permission of the instructor. 3 cr.

71. **EXPERIMENTAL FOODS.** A study of research and technological advances in the preparation and preservation of foods with an opportunity to experiment with specific foods in the laboratory. *Prereq.:* H. E. 15-16; Agr. Chem. 6 or parallel with Agr. Chem. 51. 1 lec.; 1 lab.; 2 cr.

72. **ADVANCED FOODS.** A more comprehensive study of the chemical and physical properties of foods and discussion of current research. *Prereq.:* H. E. 15-16; Agr. Chem. 6. 1 lec.; 1 2-hr. lab.; 3 cr.

73. **NUTRITION.** The application of the fundamental principles of the physiological and social sciences and their relationships to human nutrition. A knowledge of the nutritive value of foods, essential nutrients which promote growth and health, effect of food on the body, and adjustment of diet to varying income levels. Miss Light. *Prereq.:* Agr. Chem. 6 or parallel with Agr. Chem. 51. 2 lec.; 1 2-hr. lab.; 3 cr.

74. **NUTRITION IN HEALTH AND DISEASE.** A study of the modification of the normal diet and how nutrition is used as a therapeutic measure in the treatment of disease. Miss Light. *Prereq.:* H. E. 73. 2 lec.; 1 3-hr. lab.; 3 cr.

76. **NUTRITION SEMINAR.** Discussion of research and experimental work in human nutrition. Exploration of current periodical, reports, and assigned readings. Miss Light. 3 rec.; 3 cr.

81, (82), (81), 82. **PROJECTS IN CHILD DEVELOPMENT.** Principles of guidance of young children. Nursery school procedures and practices. Discussion, conferences, and supplementary projects based upon special interests of the student. Work with children in the Nursery School. Miss Rand. *Prereq.:* H. E. 25-26. 1 rec. or conference; 1-2 labs.; 1-3 cr. This course may be repeated.

83. **HOME AND FAMILY LIVING.** A discussion of the economic and social problems confronting the family and their relationships to various aspects of homemaking. Miss Turney. 3 lec. or rec.; 3 cr.

91. **PRINCIPLES AND PROBLEMS OF HOME ECONOMICS EDUCATION.** A study of the principles, procedures, and problems involved in developing school and community education with their implications for Home Economics. Miss Turney. *Prereq.:* Ed. 41-42, 52. 3 lec.; 3 cr.

93. **NUTRITION EDUCATION.** A study of the principles, procedures, and problems involved in the educational program for dietitians and nutritionists. Miss Light. *Prereq.:* H. E. 73, 74 and Psych. 1, 47. 3 lec.; 3 cr.

94. SUPERVISED TEACHING IN HOME ECONOMICS. Eight weeks of supervised teaching. Miss Turney. *Prereq.*: Ed. 41, 42, 52, and H. E. 91. 6 cr.

96. SEMINAR IN HOME ECONOMICS EDUCATION. Discussion and follow-up of problems encountered by students after having completed supervised teaching. Assigned readings and discussions of the current literature in the field of Home Economics Education. For Seniors majoring in Teacher Preparation. Hours to be arranged. Miss Turney. 3 cr. Offered last eight weeks of second semester.

98. PRINCIPLES AND TECHNIQUES OF DEMONSTRATION. Discussion of the principles employed and experience in demonstrating equipment, preparation of food, etc. Staff. *Prereq.*: For Seniors in Home Economics. Hours to be arranged. 3 cr. Offered last eight weeks of second semester.

102. METHODS USED IN HUMAN NUTRITION RESEARCH. Presentation and discussion of recent methods and tests used to evaluate nutritional status. Miss Light. *Prereq.*: Satisfactory preparation in Nutrition, Biological Chemistry, and Physiology. 3 cr.

103, 104. SPECIAL PROBLEMS. Laboratory work on special phase of (a) Foods, (b) Nutrition. The student will undertake assigned problems and readings under guidance of the instructor. Elective only upon consultation with Chairman of Department. Miss Light. 3-6 cr.

THESIS. Hours and credits, from 6-10, to be arranged.

## HORTICULTURE

ALBERT F. YEAGER, *Chairman*

Students will find the department well equipped for fundamental research on horticultural problems. In addition to the general requirements for all Graduate Students, basic chemistry and plant science courses equivalent to those ordinarily required for a Bachelor's Degree in Horticulture are prerequisites for admission to graduate study in Horticulture.

In addition to the general requirements for the Ph.D. degree, the student shall satisfy the following departmental requirements:

*Foreign Language.* The student shall satisfy the Guidance Committee that he possesses a reading knowledge of two foreign languages which may be judged to be useful to him in his field of endeavor, before he may become eligible for candidacy.

*Courses Without Credit.* The student shall be required to take such courses, without graduate credit, as may be deemed necessary to better enable him to plan and carry out his research and interpret the results. Such requirements must be satisfied *before* the student may become eligible for candidacy.

*Minors.* One or two minors may be required in fields closely related to the topic of the student's dissertation. A minimum of 6 credits in one department may be accepted as a minor.

51, 52. ADVANCED HORTICULTURE. Subject matter in any phase of horticulture (with laboratory practice if desirable) to meet the needs of special students or groups of students. Horticultural Staff. *Prereq.:* Permission to register from the Chairman of the Department. 1 to 3 cr.

53. POMOLOGY: ORCHARD FRUITS. Fundamental principles and experimental data and their applications to orchard problems including the establishment of orchards, soil management, water and fertilizer requirements, mineral deficiencies, training and pruning, fruit bud formation, pollination and fruits setting, thinning and winter injury. Mr. Latimer. 3 lec.; 3 cr.

54. POMOLOGY: SMALL FRUIT CULTURE. The culture and economic uses of the strawberry, raspberry, blackberry, blueberry, and grape. Each fruit is considered with relation to its history, propagation, planting, pruning, harvesting, marketing, insects and diseases, and domestic uses. Mr. Latimer. 2 lec.; 2 cr.

55. SYSTEMATIC SURVEY OF FRUITS. Important species and their botanical relationships. The history, distribution, and merits of each species, and the horticultural varieties developed from it. Mr. Latimer. *Prereq.:* General Botany. 2 lec.; 2 cr.

57. SYSTEMATIC SURVEY OF VEGETABLES. Important species of vegetables and culinary herbs and their botanical relationships. The history, distribution, and commercial merit of each species and the horticultural varieties developed from it. Mr. Hepler. 2 lec.; 2 cr.

58. ERICACEOUS FRUITS. A course designed to cover both highbush and lowbush blueberries and cranberries, including culture, propagation, harvesting, and marketing. Mr. W. W. Smith. 2 lec.; 2 cr.

59. GREENHOUSE MANAGEMENT. Modern methods of greenhouse management including soils, watering, costs of production and marketing, and fundamentals of plant behavior under glass. Mr. Risley. 3 cr.

60. HORTICULTURE FOR VOCATIONAL TEACHERS. Subject matter covering the latest recommendations on the varieties and culture of fruits and vegetables. Summer Session. For Vocational Agricultural teachers only. Offered in 1954. Staff. 2 hours daily lec. and lab.; 2 cr.

65. COMMERCIAL VEGETABLE PRODUCTION. The management of commercial vegetable gardens. Important vegetables and their culture including a comprehensive review of recent experimental work. Mr. Hepler. 2 lec.; 1 lab.; 3 cr.

66. NURSERY MANAGEMENT. The development of the nursery business. Factors that influence the location of a nursery, layout of the plant, soil and site, types of plants, pest control, inspection, digging, grading, storage, packing, shipping, and sales. Mr. Eggert. *Prereq.:* Plant Propagation. 1 lec.; 1 lab.; 2 cr.

78. COMMERCIAL GREENHOUSE CROPS. A survey of the principle greenhouse crops and an intensive study of their individual culture. Mr. Risley. *Prereq.:* Greenhouse Management. 2 rec.; 1 lab.; 3 cr.

91, 92. HORTICULTURE SEMINAR. A review of recent Horticultural literature and methods of investigational work. Students are required to prepare and present papers on selected topics. Department staff. Mr. W. W. Smith. 1 lec.; 1 cr.

94. PLANT BREEDING. Application of the principles of genetics to practical plant breeding. Hybridization, chemical treatments, and selection as means of producing and improving varieties. Mr. Yeager. *Prereq.:* Genetics. 2 lec.; 1 lab.; 3 cr.

101-102. METHODS OF PLANT RESEARCH. A study of the methods used in laboratory and field in plant investigations including scientific equipment such as potentiometers, thermocouples, geiger counters, refractometers, spectrophotometers, etc., and their use; project outlines, bibliographies, procedures, interpretation of data and statistical analysis of results. Mr. Eggert and staff. *Prereq.:* Plant Chemistry. 2 rec.; 2 cr.

103. NUTRITION OF HORTICULTURAL PLANTS. The effect of soil management, fertilizers, mulching materials, and mineral deficiencies on the functioning and performance of horticultural plants. Mr. Latimer. *Prereq.:* Soils, Plant Chemistry. 2 rec.; 2 cr.

104. ASEXUAL PROPAGATION OF PLANTS. The making, dissection, and critical examination of grafts, buds, cuttings, and layers of clones, especially as applied to fruit stocks. A study of regeneration, orientation, and compatibility of plant tissues. Mr. W. W. Smith. *Prereq.:* Plant Chemistry, Plant Physiology. 2 rec.; 2 cr.

105. FLOWER BUD FORMATION, POLLINATION, AND FRUIT SETTING. The influence of natural environmental factors, soil management, orchard fertilization, and resultant chemical composition of fruit plants on flower bud formation and alternate bearing; also, the effect of these and genetical factors on the production of fruit. Mr. Latimer. *Prereq.*: Plant Chemistry, General Botany, Genetics. 2 lec.; 1 lab.; 3 cr.

109. INHERITANCE IN HORTICULTURAL PLANTS. Inheritance in various horticultural crops, a review of literature, and an analysis of the future breeding possibilities of each crop. Mr. Yeager. *Prereq.*: Elementary genetics and plant breeding. 3 lec.; 3 cr.

125, 126. RESEARCH IN HORTICULTURE. Mr. Yeager and staff. *Prereq.*: Hort. 102. (May be taken concurrently.) Credits to be arranged.

THESIS. To be arranged. 6-10 cr.

## LANGUAGES

JOHN S. WALSH, *Chairman*

To be admitted to graduate study in Languages, the student must have met requirements substantially equal to those set up for the fulfillment of an undergraduate major in Languages at the University of New Hampshire.

The student must submit an acceptable thesis embodying the results of independent investigation (equivalent to 6 to 9 semester credits in courses primarily for Graduate Students) and will be required to pass a special oral or written examination, at the end of the period of graduate study, in the language and literature of his field of specialization.

A Graduate Student in Languages may take all his work in one language or in combinations of courses in two of the following languages: French, German, Latin, Spanish. Six semester hours in courses in General Language and Literature, listed below, may be counted towards the degree.

### General Language and Literature

51, 52. SURVEY OF MODERN EUROPEAN LITERATURE. The Renaissance, classicism, romanticism, and realism studied as international movements. Stress will be laid, not upon the details of each national literature, but upon the interdependence of the literature of the various countries. Conducted in English. Mr. Lepke. 3 rec.; 3 cr.

73. INTRODUCTION TO ROMANCE PHILOLOGY. The historical development of French and Spanish from Vulgar Latin. Phonology, morphology, syntax, semantics, etymology. Frequent reference is made to the spoken languages of today as well as to comparative semantics. Mr. Cryesky. *Prereq.*: Permission of instructor. 3 rec.; 3 cr.

LANGUAGES-EDUCATION (LANG-ED) 91. PROBLEMS IN THE TEACHING OF MODERN LANGUAGE IN THE HIGH SCHOOL. The special objectives, methods, and devices of modern language teaching in high schools. For prospective or actual teachers of French, German, and Spanish. *Prereq.*: Intermediate French, German, Spanish; and grade of C in Principles and Problems of Teaching in the Secondary Schools or one year's teaching experience.

### French

61-62. ADVANCED FRENCH GRAMMAR AND COMPOSITION. A systematic study of French grammar with much oral and written practice. For students who wish to perfect their command of written and spoken French. To provide as much oral practice as possible, the usual preparation for recitations will be partially replaced by three drill sessions per week. Mr. Parker, Mr. Faulkner. *Prereq.*: French Composition and Conversation or the equivalent. 6 rec.; 3 cr.

72. FRANCE TODAY. A course designed to bring the student up to date on the realities of modern French civilization. It covers the most significant aspects and trends of literary, artistic, social, economic, and political life in France today. Lectures and discussions conducted in French. Mr. Faulkner. *Prereq.*: French 14 or the consent of the instructor. 3 lec.; 3 cr.

101, 102. HISTORY OF FRENCH LITERATURE. This course is not an introduction to French literature, but complements what the student has previously learned. In general, each student is expected to study more carefully the authors of whom he has some knowledge, to fill in the gaps between courses he has taken, and to obtain an integrated knowledge of all French literature. Mr. Parker. *Prereq.*: Permission of Chairman of Department. 3 cr.

103, 104, 105, 106. SPECIAL STUDIES IN FRENCH LITERATURE. Individual guided study in special topics, with training in bibliography, note-taking, and organization of material. Examples of topics which may be selected by instructor and student in conference are: (a) Corneille and his critics; (b) the work of Jean-Jacques Rousseau; (c) the theater in the eighteenth century; (d) twentieth-century French literature; (e) French-Canadian literature. Mr. Parker, Mr. Faulkner. *Prereq.*: Permission of Chairman of Department. 3 cr.

**151-152. FRENCH LITERATURE OF THE MIDDLE AGES AND THE RENAISSANCE.** The various forms and masterpieces of French literature from the beginning to the year 1600. Readings in modern French version. Mr. Parker. 3 rec.; 3 cr. (Not offered in 1954-55.)

**153-154. FRENCH LITERATURE OF THE SEVENTEENTH AND EIGHTEENTH CENTURIES.** 3 rec.; 3 cr. Mr. Parker. *Prereq.:* Introduction to French Literature or the equivalent. (Offered in 1954-55.)

**155-156. FRENCH LITERATURE OF THE NINETEENTH AND TWENTIETH CENTURIES.** 3 rec.; 3 cr. Mr. Parker. (Alternate years; not offered in 1954-55.)

### **German**

**53-54. GERMAN LITERATURE OF THE EIGHTEENTH CENTURY.** German literature from the beginning of the century to the advent of Romanticism. Topics studied include: the rise and development of Classicism, the masterpieces of Lessing, Goethe, and Schiller, the decline and disintergration of Classicism in the eighteenth century. Collateral readings. *Prereq.:* German Civilization and Literature. 3 rec.; 3 cr. (Alternate years; not offered in 1954-55.)

**55-56. GERMAN LITERATURE OF THE NINETEENTH CENTURY.** The period from 1800 to the death of Nietzsche will be viewed in four aspects: (a) rise and development of the Romantic School, including the Romantic Opera; (b) history of the drama as reflected in the works of Kleist, Grillparzer, Hebbel, Hauptmann; (c) the novel as illustration of social and cultural conditions with emphasis on the humorists (Richter, Grabbe, Meyer, Keller, Busch); (d) the collapse of the idealistic systems of philosophy as reflected in the works of Schopenhauer and Nietzsche and others. Mr. Lepke. *Prereq.:* German Civilization and Literature. 3 rec.; 3 cr. (Alternate years; not offered in 1954-55.)

**57-58. GERMAN LITERATURE FROM 1900 TO THE PRESENT.** Including the schools of Naturalism, Impressionism, Expressionism, and "Neue Sachlichkeit". Emphasis is placed on the works of Kafka and of the Nobel-prize winners, Hauptmann, Spitteler, Thomas Mann, and Hesse. Readings and discussions will be supplemented by articles and commentaries from current German literary magazines. Mr. Lepke. *Prereq.:* Intermediate German. 3 rec.; 3 cr. (Alternate years; not offered in 1954-55.)

**103, 104, 105, 106. SPECIAL STUDIES IN GERMAN LITERATURE.** Individual guided study in special topics, with training in bibliography, note-taking, and organization of material. Examples of topics which may be selected by instructor and student in conference

are: (a) Middle High German; (b) the Renaissance; (c) Goethe; (d) German Romanticism; (e) twentieth-century German literature. Mr. Danoff, Mr. Lepke. *Prereq.*: Permission of Chairman of Department. 3 cr.

### **Latin**

53-54. THE HISTORIANS. Livy, Suetonius, and Tacitus will be studied in selected works. Illustrated lectures and outside readings will serve to provide the historical, social, and political background of Rome. Mr. Walsh. *Prereq.*: Latin Prose and Poetry or the equivalent. 3 rec.; 3 cr. (Alternate years; not offered in 1954-55.)

55-56. LITERATURE AND HISTORY. A comprehensive view of Latin Literature of the Golden Age, particularly the works of Caesar, Cicero, and Virgil. Literary value and historical content will be studied as well as such background of the history of Rome during the period as is necessary for the student or teacher of the classics. Mr. Walsh. *Prereq.*: Latin Prose and Poetry or the equivalent. 3 rec.; 3 cr. (Alternate years; not offered in 1954-55.)

LATIN-EDUCATION (LAT-ED) 91-92. PROBLEMS IN THE TEACHING OF HIGH-SCHOOL LATIN. The study of methods, objectives, and problems of teaching high-school Latin will be carried on throughout the year concurrently with work in composition and conversation. *Prereq.*: Permission of the instructor. 3 rec.; 3 cr. (Alternate years; not offered in 1954-55.)

103, 104, 105, 106. SPECIAL STUDIES IN LATIN LITERATURE. Individual guided studies in special topics, with training in bibliography, notetaking, and organization of material. Examples of topics which may be selected by instructor and student in conference are: (a) Vergil; (b) Tacitus; (c) Lucretius; (d) Horace. Mr. Walsh. *Prereq.*: Permission of Chairman of Department. 3 cr.

### **Spanish**

51. SPANISH LITERATURE UP TO 1600 AND CERVANTES. Readings and discussion of the great human creations of early Spanish Literature such as *El Poema del Mio Cid*, *El Libro de Buen Amor*, *La Celestina* and *Don Quijote*, and their social and historical background. The first part of the course will cover early Spanish literature up to Cervantes. The second part of the course will be devoted entirely to Cervantes: his life, drama, *Novelas Ejemplares*, and his masterpiece *Don Quijote*. Mr. Cryesky. *Prereq.*: Spanish 6 or equivalent. 3 lec.; 3 cr. (Not offered in 1954-55.)

52. DRAMA AND POETRY OF THE SICLO DE ORO. Discussion of the social background of the baroque period and readings of the

representative plays of Lope de Vega, Calderon, Alarcon Tirso de Molina, and the poetry of Gongora and Quevedo. Development of the prose of the period. Mr. Cryesky. *Prereq.:* Spanish 6 or equivalent. 3 rec.; 3 cr. (Not offered in 1954-55.)

55. LITERATURE OF THE XIX CENTURY. After a preliminary survey of the XVIII Century, this course will cover the readings and discussion of the main literary movements and writers of the XIX Century such as: Quintana, Espronceda, Zorrilla, Larra, Duque de Rivas, Becquer, Perez Galdos, Valera, Pereda, Clarin, and Echegaray. Social and historical background of Spain in relation to XIX Century thought in Europe. Mr. Casas. *Prereq.:* Spanish 6 or equivalent. 3 rec.; 3 cr. (Alternate years; not offered in 1954-55.)

56. CONTEMPORARY SPANISH LITERATURE. Starting with the Generation of '98, this course will cover the readings and discussion of the works of such writers as Unamuno, Azorin, Baroja, Machado, J. R. Jimenez, Ortega y Gasset, Garcia Lorca, Perez de Ayala, Casanova, Benavente, and a survey of Spanish literature and thought since 1939. Mr. Casas. *Prereq.:* Spanish 6 or equivalent. 3 rec.; 3 cr. (Alternate years; not offered in 1954-55.)

65-66. SPANISH AMERICAN LITERATURE. Lectures and discussion on the main themes of Spanish American literature through the readings of the works of the most representative authors along with a historical, social and geographical background of the New World. Mr. Casas. *Prereq.:* Spanish 6 or equivalent. 3 rec.; 3 cr.

103, 104, 105, 106. SPECIAL STUDIES IN SPANISH LITERATURE. Individual guided study in special topics, with training in bibliography, note-taking, and organization of material. Examples of topics which may be selected by instructor and student in conference are: (a) eighteenth, nineteenth, or twentieth century literature in Spain; (b) literature and civilization in Spain in Golden Age; (c) the literature of individual Latin-American countries; (d) literary relations of Europe and Latin-America. Mr. Casas, Mr. Cryesky. *Prereq.:* Permission of Chairman of Department. 3 cr.

## MATHEMATICS

DENNIS B. AMES, *Chairman*

To be admitted to graduate study in Mathematics, a candidate must have satisfactorily completed: (1) 12 semester hours in undergraduate courses in differential and integral calculus and differential equations, (2) at least 6 semester hours in more advanced undergraduate courses in Mathematics, including Advanced Calculus or its equivalent. If among these more advanced courses any prerequisites are lacking, the candidate may be required to include them in his program without credit toward the degree.

Graduate study in Mathematics is intended to provide a broad and sound training in the fundamentals. The student will, in general, be expected to include in his program, courses in analysis, algebra, and geometry. An oral examination will be required of all candidates for the Master's degree.

61-62. HIGHER ALGEBRA. The integers, the rational, real and complex number systems, congruences, theory of polynomial equations, theory of groups, vector spaces and transformations, matrices and determinants, rings, integral domains, fields, ideal theory, latices, and Boolean algebras. Mr. Conkling. *Prereq.:* Calculus II. 3 rec.; 3 cr.

65-66 ADVANCED CALCULUS. Functions of several variables, continuity, limits; partial differentiation; multiple, line and surface integrals; uniform convergence, improper integrals; Gamma and Beta functions; Fourier series and integral Stieltjes integral; Laplace transform. Mr. Conkling. *Prereq.:* Differential Equations. 3 rec.; 3 cr.

85-86. THEORY OF FUNCTIONS. An introductory course in the theory of both functions of a real variable and functions of a complex variable. Topics covered will include the real and complex numbers, elements of point set theory, various classes of functions and their properties, Riemann integral, analytic functions, Cauchy theorem, infinite series, residues, contour integration, existence theorems in differential equations. Mr. Crabtree. *Prereq.:* Applied Mathematics. 3 rec.; 3 cr.

MATHEMATICS-EDUCATION (MATH-ED) 91. The aims and values of secondary-school mathematics; the recommendations of the national committee on mathematics requirements, and the State Board requirements; the subject matter and the sequence in which it should be presented in both junior and senior high schools; techniques and instructional aids used in teaching secondary-school mathematics; errors, testing program, remedial teaching. Students preparing to teach mathematics in high school should register for this course — it is a prerequisite for Supervised Teaching in Mathematics. Lectures, assigned readings, and discussions. Mr. Perkins. *Prereq.:* Principles and Problems of Teaching in the Secondary School and Calculus I. 3 rec.; 3 cr. *May be counted as major credit only by students preparing to teach mathematics in the secondary schools.*

101-102. FUNCTIONS OF A COMPLEX VARIABLE. Complex numbers, infinite series, analytic functions, Cauchy theorem and its generalizations, contour integrals, meromorphic and entire functions, conformal mapping, analytic continuation, Riemann surfaces. Selected topics from among the following: differential equations, special functions, potential theory, Laplace transforms. *Prereq.:* Ad-

vanced Calculus (which may be taken concurrently) or Theory of Functions. 3 rec.; 3 cr.

103-104. THEORY OF FUNCTIONS OF REAL VARIABLES. The real number system; theory of point sets; fundamental theorems on continuous functions, differentiation, integration, implicit functions; measure, Lebesque integral and applications; generalized integration, different types of generalized convergence; introduction to modern functional analysis. Mr. Cunningham. *Prereq.:* Advanced Calculus (which may be taken concurrently) or Theory of Functions. 3 rec.; 3 cr.

105-106. DIFFERENTIAL GEOMETRY. The application of the calculus to the metric differential theory of curves and surfaces in Euclidean space; tensor analysis, Riemannian geometry, applications, such as the theory of relativity. Mr. Davis. *Prereq.:* Applied Mathematics. 3 rec.; 3 cr.

107-108. MODERN ALGEBRA. Abstract algebra, including theory of rings and ideals; fields and their transcendental and algebraic extensions, valuation theory; Galois theory; algebraic numbers. Mr. Rice. *Prereq.:* Higher Algebra. 3 rec.; 3 cr.

109-110. ANALYTICAL MECHANICS. Statics and dynamics of particles and rigid bodies, Lagrange's equations, Hamilton's equations, transformation theory. Linear transformations, tensors, and similar topics also are included. Mr. Davis. *Prereq.:* Applied Mathematics. 3 rec.; 3 cr.

111-112. BOUNDARY VALUE PROBLEMS. Fourier series and integral, theory of boundary value problems, linear integral equations, orthogonal functions, Bessel and Legendre functions, Laplace transformation, Fourier transforms. Applications of theory of linear operators in Hilbert space to boundary value problems. Mr. Ames. *Prereq.:* Advanced Calculus. 3 rec.; 3 cr.

113-114. MATHEMATICAL STATISTICS. Essentially a mathematical course in the theory of statistics. Mr. Kichline. *Prereq.:* Permission of the instructor. 3 rec.; 3 cr.

117-118. TOPOLOGY. Review of elementary theory of abelian groups and vector spaces. Metric spaces and elements of point set topology. Elementary homology theory of complexes, homology groups, Betti numbers, torsion coefficients. Fixed point and duality theorems. Applications to integration, differential equations, Riemann surfaces, Jordan curve theorem and its generalizations. Mr. Crabtree. *Prereq.:* Higher Algebra. 3 rec.; 3 cr.

119. INTRODUCTION TO MATHEMATICAL LOGIC. The algebra of classes and of propositions; the development of mathematics and

the avoidance of the paradoxes in several formal systems. Mr. Rice.  
*Prereq.:* Higher Algebra. 3 rec.; 3 cr.

120. INTRODUCTION TO METAMATHEMATICS. The concept of constructivity, the intuitionist critique, recursive functions and their applications, Godel's and related theorems. Mr. Rice. *Prereq.:* Introduction to Mathematical Logic. 3 rec.; 3 cr.

121-122. ADVANCED APPLIED MATHEMATICS. This is a course in certain methods of applied mathematics intended for students with a good background in pure mathematics who have *not* had extensive contact with applications. It deals with topics selected from the following: linear theory of electric circuits (including transient, Laplace transforms, and impedance), ordinary and partial differential equations, special functions, series of orthogonal functions, applied complex variables, matrices, vector methods and vector spaces, numerical computation, and integral equations. Applications are given to mechanics, electricity, heat flow, beam bending, etc. Mr. Davis. *Prereq.:* Consent of the instructor. 3 rec.; 3 cr.

123-124. ADVANCED ANALYSIS. A selection of topics in advanced analysis to meet the needs of second-year graduate students. Content of the course may vary from year to year. Members of the staff. *Prereq.:* Theory of Functions of Real Variables. 6 cr.

## MECHANICAL ENGINEERING

EDWARD T. DONOVAN, *Chairman*

To be admitted to graduate study in Mechanical Engineering a student should have completed work equivalent to that required for a Bachelor of Science Degree in this field, at the University of New Hampshire, and should have maintained an average grade of B for his undergraduate course.

55-56. INTERNAL COMBUSTION ENGINES. The internal combustion engine, including its thermodynamics, carburetion, lubrication, and vibration. Also a consideration of the fundamental principles of the gas turbine and the jet engine. Mr. Stolworthy. *Prereq.:* Strength of Materials and Engineering Thermodynamics. 2 rec.; 1 lab.; 3 cr.

65. ENGINEERING ECONOMY. The principles which form the basis of engineering procedures for obtaining the highest ratio of utility to cost. 3 rec.; 3 cr.

101, 102. ADVANCED THERMODYNAMICS. The general equations of thermodynamics and their application to fluids such as air and steam; heat transmission; current applications and advances in thermodynamics. Mr. Donovan or Mr. Stolworthy. 3 rec.; 3 cr.

**105. ADVANCED STRENGTH OF MATERIALS.** Strain energy methods, special problems in bending and lateral buckling of beams, curved beams, general bending of plates, special problems in torsion, stress concentration, deformations beyond the elastic limit and mechanical properties of materials. Mr. Kauppinen. *Prereq.:* Elementary Mechanics, Strength of Materials, and Differential Equations. 3 lec.; 3 cr.

**106. THEORY OF ELASTICITY.** This course covers the mathematical theory of elasticity. Plane stress and strain, two dimensional problems in rectangular and polar coordinates, strain energy methods, solution of two dimensional problems by means of the complex variable, elementary problems in three dimensions, torsion, bending of prismatic bars and axially symmetrical stress distribution problems are treated. Mr. Kauppinen. *Prereq.:* Advanced Strength of Materials. 3 lec.; 3 cr.

**107. VIBRATIONS.** The study of linear vibration problems of one and many degrees of freedom; undamped, damped and forced damped. An introduction to Rayleigh's Method, iteration process, Holzer's Analysis, Myklestad's Tabular Method and Dunkerley's Approximation. Mr. Kauppinen. *Prereq.:* Elementary Mechanics, Strength of Materials, Differential Equations. 3 lec.; 3 cr.

**THESIS.** To be arranged. 6-8 cr.

## **PHYSICS**

FREDERIC A. SCOTT, *Chairman*

For admission to graduate study in Physics the candidate must have satisfactorily completed undergraduate courses in Physics totaling 24 to 30 semester hours. Suitable undergraduate work in mathematics is essential and should include work in differential equations. The general aim of the program will be to give the student broad general training in fundamentals. To accomplish this, some intermediate courses numbered 51-99 may be required. Each graduate student will have to satisfy one of the following options in regard to the thesis requirement:

1. Complete a thesis for 6 hours credit and pass an oral examination on the thesis.
2. Complete a 6-credit hour course in advanced laboratory or investigation in lieu of the thesis and pass an oral examination on such work.
3. Complete a 6-credit hour graduate course in lieu of thesis and pass an oral comprehensive examination on his graduate work.

If a thesis is presented, the department requires one additional copy.

81. OPTICS. Geometrical optics covering first order theory of optical systems; aberrations; theory of stops; photometry. Physical optics covering wave propagation; interference; diffraction; polarization. *Prereq.:* General Physics; Differential Equations passed or taken concurrently. 3 rec.; 1 lab.; 4 cr.

82. HEAT. Thermometry, pyrometry, calorimetry, radiation, heat conduction and thermodynamics. *Prereq.:* General Physics; Differential Equations and Applied Mathematics passed or taken concurrently. 3 rec.; 1 lab.; 4 cr.

83-84. THEORY OF ELECTRICITY AND MAGNETISM. Electrostatics, magnetostatics, dielectric theory, electromagnetics, magnetic circuits, alternating currents, complex impedance, thermoelectricity, electromagnetic field. *Prereq.:* General Physics, Differential Equations and Applied Mathematics passed or taken concurrently. 3 lec.; 1 lab.; 4 cr.

85-86. ADVANCED MECHANICS. An analytical treatment of classical mechanics covering the methods of statics and dynamics of particles and rigid bodies both in a plane and in space, and the application of these methods to physical problems; oscillations; constrained motion; generalized co-ordinates and Lagrange's Equations. *Prereq.:* Differential Equations and Applied Mathematics passed or taken concurrently. 3 rec.; 3 cr.

91-92. MODERN PHYSICAL THEORIES. Recent developments in physics including relativity, quantum theory, introduction to wave mechanics, atomic and molecular spectra, nuclear physics and cosmic rays. *Prereq.:* Theory of Electricity and Magnetism. 3 rec.; 3 cr.

93-94. THEORETICAL PHYSICS. An introduction to the application of mathematics to physics, including such topics as advanced dynamics, theory of vibrations and sound, kinetic theory, etc. *Prereq.:* Differential Equations and Applied Mathematics. 3 rec.; 3 cr.

95-96. ADVANCED LABORATORY. Laboratory work of research type. Special problems are assigned to the student who is placed on his own initiative. *Prereq.:* Senior standing in Physics in College of Technology. 2 lab.; 2 cr.

97. ELECTRICAL DISCHARGE THROUGH GASES. Properties of gaseous ions, motion of electrons in gases, the discharge tube, positive and negative rays, thermionic emission, photo-electricity, critical potentials, etc. *Prereq.:* Theory of Electricity and Magnetism. 3 rec.; 1 lab.; 4 cr.

99. SPECIAL TOPICS. A course designed to cover any selected topics not sufficiently well covered in a general course. *Prereq.:*

Differential Equations and Applied Mathematics passed or taken concurrently. Senior standing in Physics in College of Technology. 1, 2, or 3 cr.

111-112. THEORETICAL PHYSICS. Methods of mathematical and theoretical physics applied to mechanics, hydrodynamics, dispersion theory, etc. 3 cr. (Previously Physics 151-152.)

113-114. ADVANCED THEORETICAL PHYSICS. Topics in theoretical physics selected from the following fields: vibrations and waves, advanced dynamics, hydrodynamics, heat flow, potential theory, theory of radiation, advanced quantum mechanics, quantum theory of fields, relativity. 3 cr. (Previously Physics 169-170.)

115-116. ELECTRODYNAMICS. The classical theory of electrostatics and magnetostatics, including advanced methods of solution of special problems, conduction in metals and semi-conductors and Fermi-Dirac statistics, electromagnet fields, oscillations in coupled circuits and lines, electric waves, and other topics as time may allow. 3 cr. (Previously Physics 153-154.)

117-118. QUANTUM MECHANICS. An introductory course covering the physical concepts and mathematical principles underlying the formulation of wave and matrix mechanics with application to simple problems. 3 cr. (Previously Physics 157-158.)

119-120. NUCLEAR PHYSICS. Theoretical and experimental aspects of nuclear processes. 3 cr. (Previously Physics 155-156.)

121. RELATIVITY. Special theory of relativity, tensor calculus, relativity mechanics, curvature of space and time, world geometry, generalized theory of gravitation. 3 cr. (Previously Physics 165.)

122. THERMODYNAMICS. A theoretical course in classical thermodynamics. 3 cr. (Previously Physics 171.)

123. STATISTICAL MECHANICS. Basic principles and general methods of statistical mechanics with application to physical problems. 3 cr. (Previously Physics 166.)

124. ELECTROMAGNETIC THEORY OF LIGHT. Advanced topics in geometrical and physical optics, aberration theory, diffraction of light, propagation in crystalline media, dispersion, absorption, theory and design of optical instruments. 3 cr. (Previously Physics 168.)

125. INTRODUCTION TO SOLID STATE PHYSICS. Classification of solid types, Bloch functions, Brilloin Zones, crystal momentum, band approximation, electrons and holes in electric and magnetic fields, conductivity, and Hall effect in semi-conductors, rectifiers and transistors. 3 cr. (Previously Physics 167.)

140. SPECIAL TOPICS. Any special fields of study not covered by the above graduate courses will be included in this course. Choice of topic to be determined by class. 1, 2, or 3 cr. May be taken more than once. (Previously Physics 159.)

141-142. INVESTIGATION AND RESEARCH. Theoretical or experimental investigation of a problem in Physics. 3 cr. (Previously Physics 161-162.)

143-144. SEMINAR. Reports on recent researches and investigations in the various fields of Physics. Required of all majors and Graduate Students in Physics. No credit. (Previously Physics 163-164.)

THESIS. 6 cr.

## **POULTRY HUSBANDRY**

W. C. SKOGLUND, *Chairman*

To be admitted to graduate study in Poultry Husbandry an applicant is expected to have had sufficient undergraduate Poultry Husbandry to qualify for special work in this field.

53, 54. POULTRY PROBLEMS. Students are given a selection of various problems and are required to compile and present accurate and detailed information in their solution. The Staff. 1 to 3 cr.

101, 102. ADVANCED POULTRY DISEASES. A study of the causes and effects of disease applied to the body as a whole. Lectures supplemented by laboratory demonstrations of the basic pathology of diseased tissue. A detailed discussion of diagnosis, prevention, control, and treatment of poultry diseases. Mr. Dunlop, Mr. Corbett. *Prereq.:* Poultry Diseases, General Bacteriology, Histology or their equivalent. 3 cr.

103, 104. ADVANCED POULTRY SCIENCE — NUTRITION, BREEDING, MARKETING. A comprehensive study of (1) metabolism and physiology of digestion with special emphasis on nutrient needs and deficiency diseases of poultry; (2) the physiology of reproduction, and inheritance of morphological, physiological, and color characteristic of poultry; (3) problems involved in the production, processing and sale of poultry products. Mr. Skoglund, Mr. Ringrose, Mr. Collins. *Prereq.:* Poultry Breeding, Poultry Marketing, and Poultry Feeding or their equivalent. 3 cr.

105, 106. SEMINAR. A survey of recent literature and research in Poultry Husbandry. Mr. Skoglund. 1 cr.

107, 108. SPECIAL PROBLEMS. The student with the instructor selects a problem. He is then required to outline, organize, and con-

duct the necessary research, accurately gather and evaluate the pertinent data, and present the results of the study in a written report. The Staff. Hours and credits not to exceed 3 each semester are to be arranged.

109, 110. THESIS. Hours and credits, from 6 to 10, are to be arranged.

111, 112. AVIAN HISTOPATHOLOGY. The first semester consists of a course in general histopathology. The second semester will include a discussion of special histopathology and its relationship to diagnosis and the control of poultry diseases. Mr. Dunlop. *Prereq.:* Poultry Husbandry 101, 102, Histology, and permission of the instructor. 3 cr.

## PSYCHOLOGY

HERBERT A. CARROLL, *Chairman*

In addition to meeting the requirements for entrance into the Graduate School, students admitted to graduate study in Psychology must have had a minimum of 12 credits in undergraduate courses in Psychology. It is desirable that these credits include a course in Mental Hygiene and one in Statistics.

Before the end of the first week of his first semester of graduate study, each student will submit to the Department Chairman for approval an outline of his proposed program of study. This proposed program must include:

- (1) A statement of professional objectives.
- (2) A complete schedule of courses.
- (3) An election of either a thesis, for which 6 credits will be given, or a general comprehensive examination, for which no course credit will be given.

An oral examination is required of all candidates for the Master's Degree.

51. PSYCHOLOGY OF CHILDHOOD. The mental processes and reactions of the normal child from birth to adolescence studied in order to obtain a comprehensive understanding of the development of the personality of the child. Special emphasis is placed on problems of parents and teachers and the importance of childhood for later adjustment. Mr. Coules. *Prereq.:* General Psychology. 3 lec.; 3 cr.

52. PSYCHOLOGY OF ADOLESCENCE. An examination of the physical, psychological, and social development of the individual during the period between childhood and maturity, and the implications for the individual, parent, teacher, and community of the

problems characteristic of this period. Mr. Dowd. *Prereq.*: General Psychology. 3 lec.; 3 cr.

57. EXPERIMENTAL PSYCHOLOGY. A study of experimental work in psychology, supplemented by class experiments. Emphasis will be placed on scientific method and experimental procedure. Mr. Haslerud. *Prereq.*: General Psychology. 1 lec.; 2 lab.; 3 cr.

58. PSYCHOLOGY OF LEARNING. A study of experiments on the modification of behavior with emphasis on the practical implications for more insights, guided learning, better memory, and extended transfer. Mr. Haslerud. *Prereq.*: General Psychology. 3 lec.; 3 cr.

63. DIFFERENTIAL PSYCHOLOGY: THE FEEBLEMINDED AND THE GIFTED. A study of individual differences in intellectual development focusing on the sub-normal and the gifted as deviants from the norm. Mr. Dowd. *Prereq.*: Psychology 2 and 51. 3 lec.; 3 cr.

67. STATISTICS IN PSYCHOLOGY. A study of the problems and methods involved in the statistical treatment of quantitative data in psychology. Both the computation and interpretation of elementary statistical measures will be stressed. Mr. Baler. *Prereq.*: General Psychology. 2 lec.; 1 lab.; 3 cr.

74. PSYCHOLOGY OF PERSONALITY. A scientific approach to the analysis of personality in terms of structure, development, dynamics, and methods of measurement. Mr. Baler. *Prereq.*: General Psychology and Mental Hygiene. 3 lec.; 3 cr.

78. PHYSIOLOGICAL PSYCHOLOGY. A study of the functions of the nervous system and its effect on the discriminative and motivational aspects of behavior. Emphasis will be placed on vision, audition, feeling, emotion, sex, hunger, etc. *Prereq.*: General Psychology. 3 lec.; 3 cr.

83. SYSTEMATIC PSYCHOLOGY. The complex expansion of contemporary psychology as seen in historical perspective. A consideration of some of the major antecedents in philosophy, theology, and the physical sciences. Emphasis is placed on the subsequent extensive development of psychology in the United States in the form of complementary schools and systems of thought and research. Mr. Baler. *Prereq.*: General Psychology. 3 lec.; 3 cr.

87. APPLIED PSYCHOLOGICAL TESTING. The planning and execution of testing programs in the institutional setting. Special emphasis upon practical problems of administration and preparation or normative and validating data. The conference-laboratory method will be emphasized. Students will be required to complete a project that will bear definite relationship to the local institutional program.

Open only to practicing teachers, counsellors, guidance and personnel workers. Class enrollment limited to 20 students. Mr. McIntire. *Prereq.*: Consent of the instructor. 3 cr. *Offered only as an extension course.*

88. COUNSELING TECHNIQUES FOR TEACHERS. A study of the tools and techniques involved in counselling and guidance. Special emphasis will be placed upon understanding of the psychological principles involved in promoting the personal, educational, vocational, and social growth of young people. The student-centered approach will be emphasized. Reports and papers will be required. Mr. McIntire. *Prereq.*: Consent of the instructor. 3 cr. *Offered only as an extension course.*

89, (89). MENTAL HYGIENE FOR TEACHERS. A study of the fundamental needs of human beings, with special emphasis on the mental and emotional conflicts of secondary-school students arising from the thwarting of these needs. Ways of recognizing these conflicts by their manifestations, and of helping students to resolve them will be treated extensively in the course. Attention will also be given to the mental hazards of the teaching profession. Mr. Dowd. *Prereq.*: General Psychology or equivalent. 3 cr. *Not open to students who have completed Psych. 47.*

95. ADVANCED GENERAL PSYCHOLOGY. A systematic study of current psychology to help the student, by lectures, demonstrations, and reports, to obtain a broad, integrated view of the subject as both science and art. Mr. Haslerud. *Prereq.*: 12 semester credits in psychology. 3 cr. *Required of all undergraduate majors in psychology.*

98. SEMINAR IN PSYCHOLOGY. An extensive term paper on subjects chosen by the individual students. This project in library research meets the department's requirement for a comprehensive paper. Mr. Carroll. *Prereq.*: 15 semester credits in Psych. 3 cr. *Required of all undergraduate majors in psychology.*

105-106. CLINICAL PSYCHOLOGY. A study of procedures in the treatment of functional behavior disorders. Directive and non-directive methods in psychotherapy are compared and critically evaluated. Special attention is given to the client-centered approach as presented by Rogers. During the second semester attention is concentrated on actual cases. Specific techniques in psychotherapeutic interviews are demonstrated and evaluated through the use of recorded interviews. Students are given practice in conducting interviews with fellow students. Mr. Carroll. *Prereq.*: Permission of the instructor. 3 cr. each semester. (106. Clinical Psychology was formerly 106. Clinical Problems.)

110. TECHNIQUES OF COUNSELING. A study of the psychological factors, techniques, and procedures involved in the analysis of the individual's vocational, educational, and social adjustments. Mr. McIntire. *Prereq.*: A course in statistics and permission of the instructor. 3 cr.

114. STATISTICAL PROBLEMS IN PSYCHOLOGY. A study of the nature of inferential statistics as applied to the analysis and interpretation of experimental data. Mr. Coules. *Prereq.*: Statistics in Psychology. 3 cr.

121. GROUP TESTING. Demonstration and experience in the administration and interpretation of group tests of personality, interest, achievement, capacity, and aptitude. Students will be required to do field work in testing. Mr. McIntire. *Prereq.*: Statistics in Psychology and consent of the instructor. 3 cr.

123. INDIVIDUAL TESTING. Demonstrations and experience in the administration and interpretation of individual tests. Detailed study will be made of the Terman-Merrill Revision of the Binet-Simon Scales and the Wechsler-Bellevue Intelligence Scales. Students will be required to purchase testing materials and to do field work in testing. Mr. Bower. *Prereq.*: Statistics Psychology and consent of the instructor. 3 cr. (Formerly 122. Individual Testing.)

131. GRADUATE SEMINAR. An intensive examination of the research process as the attempt to discover answers to meaningful questions through the application of scientific procedures. Attention is focused on the relation of theory to research, experimental design, problems of measurement, techniques for data collection, and interpretation of results. Mr. Baler. *Prereq.*: Permission of the instructor. 3 cr.

141. PERSONALITY DYNAMICS. An evaluation of the major theories of personality dynamics. Special emphasis is placed upon the role of perception and learning. Mr. Dowd. *Prereq.*: Psychology of Personality, or its equivalent. 3 cr. (Formerly 142, Personality Dynamics.)

152. INTRODUCTION TO PROJECTIVE TECHNIQUES. A study of the theory and rationale of projective methods of personality evaluation. Specific instruments such as the Rorschach, Thematic Apperception, sentence completion, and drawing tests will be considered. The course provides an orientation to projectives rather than instruction in the administration and interpretation of any one test. Mr. Bower. *Prereq.*: Individual Testing, Personality Dynamics, and consent of the instructor. 3 cr.

162. PSYCHOLOGY OF PERCEPTION. A study of the experiments and theories dealing with the fundamental stimulus situation in the

internal and external environment. This knowledge of how the organism sees and interprets his world has many applications, e.g., social stimulation, self regard, and a basis for the projective tests. Mr. Haslerud. 3 cr.

172. GRADUATE INTERNSHIP. Practical work experience in clinical psychology and allied fields. Students will be assigned to institutions and serve under experienced personnel and under supervision of departmental instructors. *Prereq.:* Open to a limited number of graduate students who have completed Clinical Psychology and who secure permission of the departmental supervisor. Credit to be arranged up a maximum of 6 cr.

181, 182. READING AND RESEARCH IN PSYCHOLOGY. With the advice and consent of the instructor, a student prepared by training and experience to do independent work may register for this course. The student will undertake assigned problems and readings under the guidance of the instructor. Mr. Carroll, Mr. Haslerud. Hours and credits by arrangement.

THESIS. 6 cr.

## SOCIOLOGY

RAYMOND E. BASSETT, *Chairman*

The Sociology Department offers graduate work, leading to the degree of Master of Arts, for students having a special interest in one or more of the following fields: Crime in American society, cultural anthropology, mass communication, development of sociological thought, race relations. Applicants for admission to graduate study in Sociology who meet the academic and scholastic requirements of the Graduate School and who offer a minimum of 12 undergraduate credits in Sociology will be accepted with the understanding that both their guided study in Sociology 181, 182 and their theses will be in one of these five special fields.

Before being recommended for the Master of Arts Degree a candidate must earn 30 semester hours' credit, including thesis. No more than 6 semester hours' credit may be earned in other departments.

52. POPULATION ANALYSIS. A seminar course in demography using as its principal materials data from the U. S. Census of Population and U. S. Vital Statistics. Growth and levelling of city and state populations; distribution of such factors as age, sex, marital status, and years of schooling; differential fertility and mortality; geographical mobility. Training in statistics not required. Mr. Bassett. 3 lec. or rec.; 3 cr.

71. CRIME IN AMERICAN SOCIETY. Development of concepts concerning who is the criminal. Survey of theories to explain crime.

Analysis of the amount and distribution of crime. Discussion of criminal law: its origins, definitions, and influence on public attitudes. Social treatment of criminals: police, courts, prisons, probation, and other attempts at social control. Modern American attempts to reform the law and prisons. Application of scientific findings to the prevention of crime. Mr. Prell. 3 lec. or rec.; 3 cr.

72. THE FAMILY. The rise of the marriage institution and the family: the present American family, its functions and adjustment; effects of urbanization; divorce, desertion, changing status of women, child welfare, and related modern problems; a consideration of recent research into factors predictive of successful marriage. Mr. Nielson. 3 lec. or rec.; 3 cr.

73, 74. AN INTRODUCTION TO SOCIAL WORK. A survey of the field of social work including history of social work; public welfare on the federal, state and local level; case work in various social welfare settings; social group work; and community organization for social welfare. Mr. Nielson. 3 lec. or rec.; 3 cr.

75. METHODS OF SOCIAL RESEARCH. Analysis of research problems. Designing field studies and experiments. Practice in sampling, schedule construction, and interviewing techniques. Emphasis is on methods of obtaining data rather than on statistical analysis. Mr. Bassett. 3 lec. or rec.; 3 cr.

93. MASS COMMUNICATION. First noting how face-to-face communication binds together and integrates the primary group, the course goes on to show how press, radio, and screen perform this function in urban, regional, and national communities. Development and operation of the principal mass media are described. Content of their messages, characteristics of their audiences, and probable impact are analyzed, using current periodicals, films, and programs as material. Mr. Bassett. *Prereq.:* Permission of the instructor. 3 lec. or rec.; 3 cr.

95, 96. SOCIAL RESEARCH SEMINAR. A laboratory or field work course in which actual research, requested by a sponsor, is planned and carried out. Analysis of problems, choice of appropriate research methods, construction of instruments, coding, tabulation, quantitative analysis of data, and presentation of results are carried out by the seminar, organized as a research agency. Mr. Bassett. *Prereq.:* Soc. 75. 3 lab.; 3 cr.

97. SOCIAL SERVICE FIELD WORK. Designed to give the students an understanding of social work through observation and participation. Lectures, readings, and conferences will be offered during the college year. The field work requirement may be satisfied either during the college year in co-operation with neighboring

social agencies or during the summer by eight weeks' work with other accredited social work institutions. The Department will arrange for a limited number of student summer placements with well supervised settlements, correctional institutions, and case work agencies in urban centers. In most cases agencies offer no remuneration beyond living expenses. Mr. Nielson. *Prereq.:* Permission of the instructor. 6 cr. upon completion of 200 hours of field work plus seminars.

181, 182. READING AND RESEARCH IN SOCIOLOGY. With the consent of the instructor, a student prepared by training and experience to do independent work may register for a reading and research course. The student will undertake problems and readings under the guidance of the instructor. Hours and credits by arrangement.

- A. Crime and its social treatment. Mr. Prell
- B. Cultural Anthropology. Mr. Prell
- C. Mass communication. Mr. Bassett
- D. Development of sociological thought. Mr. Moss.
- E. Race relations. Mr. Nielson.

189, 190. THE DEVELOPMENT OF SOCIOLOGICAL THOUGHT. The history of the development of sociology from Plato to the present day. During the first semester, the emphasis is on the nineteenth century, with special reference to the writings of Comte, Spencer, and the European systems of thought. During the second semester, analysis is made of twentieth-century sociological thought, with special reference to American sociology. Mr. Moss. 3 lec. or rec.; 3 cr.

THESIS. In one of the fields specified under Sociology 181, 182. Usually 6 cr. but up to 10 cr. in rare instances with permission of advisor.

## ZOOLOGY

GEORGE M. MOORE, *Chairman*

To be admitted to graduate study in Zoology students must have completed their basic undergraduate preparation in some field of the biological sciences, with at least two years' work in Zoology. Suitable training in botany, chemistry, and physics is also necessary. Students lacking these requirements may be admitted but will be required to complete certain courses which do not give graduate credit.

When a student is admitted to candidacy for the Master of Science Degree in Zoology, the Chairman of the Department (with the

advice of the staff member in charge of the thesis) shall determine, in light of the student's objectives, courses and other requirements to be completed by the candidate. Candidates for the Master's Degree in Zoology will be required (a) to present at least one graduate credit in Zoology Seminar (Zool. 87, 88), and (b) to pass an oral examination covering (1) their general preparation in the field; (2) their graduate and undergraduate courses in the biological sciences; and (3) the thesis.

**THESIS REQUIREMENT.** A thesis may be required of students securing the Master's Degree in Zoology. The number of thesis credits will be *six*. In certain cases, where it seems appropriate in the light of the student's educational objectives, the thesis requirement may be waived. Permission to waive the thesis requirement will be granted on recommendation of the *committee on thesis requirement* consisting of three members of the graduate faculty of the Zoology Department. When permission is granted to waive the thesis requirement, the student shall present two graduate credits in Zoology Seminar. (Zool. 87, 88).

51. **PARASITOLOGY.** An introductory course concerned with some of the more important parasites causing diseases of man and animals. Living materials will be used as far as possible. Mr. Bullock. *Prereq.:* Biol. 2 and one year of Zool. 2 lec.; 2 lab.; 4 cr.

55. **MARINE INVERTEBRATE ZOOLOGY.** A survey of the major invertebrate groups with emphasis on the inshore marine fauna. About one-fourth of the laboratory time will be devoted to field work with emphasis on natural history and ecological relationships. Mr. Moore and Staff. *Prereq.:* General Zoology. 3 rec.; 3 labs.; 6 cr. (*Offered in Summer only.*)

56. **FRESHWATER AND TERRESTRIAL INVERTEBRATES.** The natural history and taxonomy of the invertebrates of land and freshwater, exclusive of insects, with special reference to those of Eastern North America. Mr. Moore. *Prereq.:* General Zoology. 1 rec.; 2 lab.; 3 cr. *Open to students who have credit for Zool. 56 prior to January, 1952.*

59. **GENERAL PHYSIOLOGY.** The chemical and physical nature of the living substance. The processes of metabolism, movement of materials, irritability, response. Lectures, assigned topics, and laboratory experiments. Miss Travis. *Prereq.:* Biol. 2, one year of Zoology, a year of college physics, and a course in organic chemistry. 3 lec. or rec.; 1 lab.; 4 cr.

60. **COMPARATIVE PHYSIOLOGY.** A course designed to study in a comparative manner the functional systems found throughout the animal kingdom. Major study will be placed on the functional

or ecological adaptations of the organism to its environment. Miss Travis. *Prereq.*: Zool. 7, 18, or 59, and a course in Organic Chemistry. 3 lec. or rec.; 2 lab.; 5 cr.

61. GENETICS. A study of the physical basis of inheritance, expression, and interaction of the hereditary units, linkage, and variation. The application of Mendelian principles to plant and animal breeding. Mrs. Richardson. *Prereq.*: Biol. 2, or General Botany and Principles of Zoology. 3 lec. or rec.; 3 cr.

64. NEUROLOGY. Practical study of morphology, physiology, and histology of the human nervous system. Mrs. Richardson. *Prereq.*: Zool. 18. 3 lec. or rec.; 1 lab.; 4 cr.

65. EMBRYOLOGY. A study of the fundamental principles of development. The developmental process from the egg to the formation of the body and the establishment of the principal organs and systems. Miss Allen. *Prereq.*: Comparative Anatomy. 2 lec.; 2 lab.; 4 cr.

66. ELEMENTS OF HISTOLOGY AND MICROMECHANIQUE. A study of the microscopic anatomy of principal tissues and organs of vertebrates with an introduction to general histological technique. Mr. Bullock. *Prereq.*: Comparative or Human Anatomy. 2 lec.; 2 lab.; 4 cr.

77. NATURAL HISTORY AND TAXONOMY OF THE VERTEBRATES. A study of vertebrate animals exclusive of birds; their habits, habitats, life histories with special reference to those occurring in Eastern North America. Techniques of collection, identification, and preservation are included. Mr. Sawyer. *Prereq.*: General Zoology. 3 rec.; 2 lab.; 5 cr.

87, 88. ZOOLOGY SEMINAR. Seminar discussions on current zoological literature conducted each week. Primarily for Seniors majoring in Zoology and for Graduate Students. Graduate Students will be required to prepare a term paper summarizing recent contributions on a particular topic. Graduate Students may present no more than 2 credits in Zoology 87, 88 in completing the 30 hours required for a Master's Degree. Mr. Moore and staff. *Prereq.*: Permission of the Department Chairman. 1½ hours per week. 1 cr.

94. ANIMAL ECOLOGY. A study of the problems of Animal Ecology concerned with both the individual and the community. The special ecological problems in the marine, freshwater and terrestrial environments will be considered. Mr. Swan, Mr. Sawyer. *Prereq.*: Zool. 55 or 56 or 77, and Plant Ecology. 3 rec.; 2 lab.; 5 cr.

97, 98. SPECIAL PROBLEMS. Advanced students may elect a special problem provided they present a detailed outline of the subject and can furnish adequate proof of their ability to carry it out

with equipment available. Mr. Moore and staff. *Prereq.*: Permission of the Department Chairman. 1-4 cr.

111, 112. PROBLEMS IN (a) ANIMAL ECOLOGY, (b) EMBRYOLOGY, (c) INVERTEBRATE ZOOLOGY, (d) PARASITOLOGY, (e) PHYSIOLOGY, (f) VERTEBRATE NATURAL HISTORY AND TAXONOMY. This course involves reading, laboratory work, and conferences on special problems approved by the staff. Two copies of a formal report must be filed with the Department Chairman before credit is given for this course. Staff. *Prereq.*: Permission of the Department Chairman. 1-4 cr.

136. ORNITHOLOGY. A study of birds; their identification, migrations, life histories, and economic importance with special reference to those of Eastern North America. This course will meet with Zool. 36. Students will be expected to do extra reading and laboratory work. Not open to students who have credit for Zool. 36. Mr. Sawyer. *Prereq.*: Zool. 7. 1 rec.; 2 lab.; 3 cr.

151. PARASITOLOGY. An introductory course concerned with some of the more important parasites, causing diseases of man and animals. This course will meet with Zool. 51. Students will be expected to do extra reading and laboratory work. Not open to students who have credit for Zool. 51. Mr. Bullock. *Prereq.*: 14 hours of Zoology. 2 lec.; 2 lab.; 4 cr.

155. MARINE INVERTEBRATE ZOOLOGY. A survey of the major invertebrate groups with emphasis on the inshore marine fauna. About one-fourth of the laboratory time will be devoted to field work with emphasis on natural history and ecological relationships. This course will meet with Zool. 55. Students will be expected to do extra reading and laboratory work. Not open to students who have credit for Zool. 55. Mr. Moore and staff. *Prereq.*: General Zoology. 3 rec.; 3 labs.; 6 cr. (*Offered in Summer only.*)

159. GENERAL PHYSIOLOGY. The chemical and physical nature of the living substance. The processes of metabolism, movement of materials, irritability, response. This course will meet with Zool. 59. Students will be expected to do extra reading and laboratory work. Not open to students who have credit for Zool. 59. Miss Travis. *Prereq.*: 16 hours of Zoology, a year of college physics, and a course in organic chemistry. 3 lec.; 1 lab.; 4 cr.

160. COMPARATIVE PHYSIOLOGY. A course designed to study in a comparative manner the functional systems found throughout the animal kingdom. Major study will be placed on the functional or ecological adaptations of the organism to its environment. This course will meet with Zool. 60. Students will be expected to do extra reading and laboratory work. Not open to students who have credit

for Zool. 60. Miss Travis. *Prereq.*: Zool. 7, 18, or 59, and a course in Organic Chemistry. 3 lec. or rec.; 2 lab.; 5 cr.

177. NATURAL HISTORY AND TAXONOMY OF THE VERTEBRATES. A study of vertebrate animals, exclusive of birds; their habits, habitats, life histories with special reference to those occurring in Eastern North America. Techniques of collection, identification, and preservation are included. This course will meet with Zool. 77. Students will be expected to do extra reading and laboratory work. Not open to students who have credit for Zool. 77. Mr. Sawyer. *Prereq.*: Zool. 7. 3 rec.; 2 lab.; 5 cr.

194. ANIMAL ECOLOGY. A study of the problems of Animal Ecology concerned with both the individual and the community. The special ecological problems met in the marine, freshwater, and terrestrial environment will be considered. This course will meet with Zool. 94. Students will be expected to do extra reading and laboratory work. Not open to students who have credit for Zool. 94. Mr. Swan, Mr. Sawyer. *Prereq.*: Zool. 55 or 56 or 77, and Plant Ecology. 3 rec.; 2 lab.; 5 cr.







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